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RESERVE LEVELS FOR STORABLE FARM PRODUCTS

A STUDY OF FACTORS RELATING TO THE DETERMINATION OF RESERVE LEVELS FOR STORABLE FARM PRODUCTS

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PRESENTED BY MR. ELLENDER

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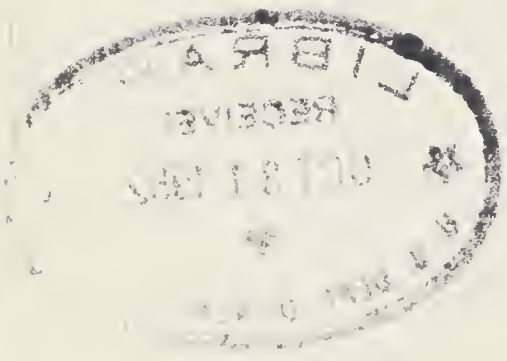

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FOREWORD

Conditions have changed sharply since the Agricultural Act of 1949 was passed.

At that time the Commodity Credit Corporation had a large volume of price-supporting loans outstanding on the 1948 crops and expected to have even greater responsibilities in supporting the prices of the 1949 crops.

Congress was concerned that excessive stocks might accumulate as a result of the price-support programs. It sought to meet the problem by providing in the Agricultural Act of 1949 (Public Law 439, 81st Cong.), which authorized price supporting loans at 90 percent of parity on the basic crops under normal supply conditions, that the Secretary of Agriculture could lower the loan level when supplies exceeded normal.

The minimum mandatory loan level was reduced 1 percent of parity for each 2-percent increase in supplies after corn, wheat, and rice supplies exceed normal by more than 2 percent or cotton and peanut supplies exceed normal by more than 8 percent until supplies reach 124 percent of normal. Increases in supplies have no further effect on minimum loan levels, however, after they exceed 30 percent above normal and the minimum loan level reaches 75 percent of parity.

Conditions have changed so sharply as a result of our defense mobilization efforts beginning in 1950 that for the past two crop-years, 1949–50 and 1950–51, domestic consumption plus exports have exceeded current production. This also will be true for the crop year ending September 30, 1952.

The Senate Committee on Agriculture and Forestry now has before it several bills which would amend the 1949 act.

Our farm-price supports should be reexamined at the present time from the standpoint of (1) their effectiveness in encouraging farmers to increase production to meet our current production goals, (2) their effectiveness in protecting producers of all major farm crops if market demand should fall off after large crops have been achieved, and (3) their effectiveness in carrying forward reserve supplies of storable commodities essential to a stable economy.

In order that the committee might have more basic facts regarding possible needs for reserves of storable commodities during this mobilization period, I asked the Bureau of Agricultural Economics of the Department of Agriculture to make a comprehensive study of the problem. I believe that this report on reserve levels for storable commodities will be most useful to the committee.

ALLEN J. ELLENDER,
Chairman, Senate Committee on Agriculture and Forestry.

LETTER OF TRANSMITTAL

DEPARTMENT OF AGRICULTURE,
Washington, April 14, 1952.

Hon. ALLEN J. ELLENDER,
Chairman, Committee on Agriculture and Forestry,
United States Senate.

DEAR SENATOR ELLENDER: I am transmitting herewith a report on factors relating to the determination of reserve levels for storable farm products, especially the grains although some consideration is also given to cotton. This study has been undertaken in accordance with your request of July 9, 1951.

Although this report does reach certain conclusions as to the level of stocks necessary to offset yield variations and does present many facts relating to the various questions involved in determining storage policy, these conclusions and facts are not recommendations. Rather, the effort has been to set forth the facts and questions which must be considered by farmers and others interested in agriculture, including the Congress and the appropriate policy officials of the Government, in arriving at a judgment on the size of stocks or reserves and the terms under which they should be carried.

This study was prepared under the immediate direction of Messrs. O. V. Wells and Karl Fox of the Bureau of Agricultural Economics, working, as you suggested, with Mr. Walter W. Wilcox of the Legislative Reference Service, Library of Congress. Mr. Wilcox's advice and assistance are gratefully acknowledged.

We hope that this study will be useful to the committee in connection with the storage and price-support problems with which it is now or may in the future be concerned.

Sincerely yours,

CHARLES F. BRANNAN, *Secretary.*

RESERVE LEVELS FOR STORABLE FARM PRODUCTS

A Study of Factors Relating to the Determination of Reserve Levels for Storable Farm Products

I. General Report

This study, which was undertaken at the request of the chairman of the Senate Committee on Agriculture and Forestry, endeavors to analyze yield and other data in order to indicate the stocks or reserve levels which will be necessary to offset specified yield variations for three of the main storable crops—corn, cotton, and wheat—and to state the several leading policy questions which need to be considered by farmers, the Congress, and public officials in arriving at a final determination as to what stocks or reserve levels seem most desirable or feasible, including the determination of the conditions under which such stocks might be carried and released.

STORAGE OBJECTIVES

Stocks of farm products may be carried over from one crop year to another for three main purposes: (1) To provide normal working stocks, (2) to offset variations in production, and (3) to stabilize prices and offset variations in demand, including provision for meeting war or defense emergencies.

Some part of a storable crop must be carried over at the end of a marketing season in order to maintain the continuity of processing and distribution during the early part of the next season. Working or "pipeline" stocks of this sort are essential to normal business operations, and are carried ordinarily by private firms and individuals. Working or convenience stocks of this kind are usually relatively small as compared with a normal harvest.

A major objective of storage policy in recent years has been to reduce fluctuations in farm prices and smooth out the flow of the main storable crops into domestic use and the foreign market. One of the basic causes of such fluctuations is the variability of crop yields and acreage. Variations in crop yields from year to year are mainly due to factors beyond human control.

If we do not want such pronounced changes in consumption and exports as occur in crop yields or if we want greater stability in the price structure, a part of the fluctuations in production must be absorbed by storage operations. Year-to-year variations in crop yields appear sufficiently random that we can calculate, on the basis of past experience, the approximate likelihood of different yields or sequences of yields in the near future. The level of stocks carried to offset such probable variations must depend on the importance of achieving given degrees of stability relative to the costs or burdens involved.

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Excessive price fluctuations have also arisen from variations in demand. Low farm prices can result from a decline in demand as well as from an increase in supply. Under existing price-support policies, stocks tend to build up automatically in years of above-average yields or as demand slackens, and are available for release when demand increases or yields are unfavorable.

In addition to normal peacetime variations in demand, there are special demands connected with mobilization or war. These demands depend upon strategic considerations peculiar to a given emergency and, although there is no desire to minimize the value of reserves for strategic purposes, an extended discussion of them is beyond the scope of this report.

Requirements for working stocks.—The adequacy of a working stock to maintain normal processing and distribution depends not only upon its over-all size and location but also upon its distribution as to types, grades, and other relevant subcategories. If the inventories are well balanced, recent experience indicates that year-end stocks of about 100 million bushels of wheat and 2 million bales of cotton appear adequate for working purposes. The grade distribution of the carryover is not so important in the case of corn, and year-end stocks of 150 million bushels appear adequate to maintain normal processing, distribution, and feeding during the period before new crop supplies become available in quantity. About an equal combined tonnage of other feed grains (oats, barley, and grain sorghums) would be needed for similar purposes.

STOCKS TO MEET SPECIFIED YIELD CONTINGENCIES

Estimates of stock requirements must be based on an appraisal of the contingencies to be covered. In this discussion, we assume that requirements for farm products will continue for the next several years at a relatively high level. Total production and consumption of farm products are now at near-record levels and estimated requirements, including export allowances, are such as to indicate that for some time farmers will need at least to maintain total crop acreage at the level actually planted in 1951.

Also, we assume that the yield fluctuations to be expected over the next several years will be similar to those actually experienced over the 50 years, 1901 through 1950. Yield variations during that period were first measured as deviations from 9-year moving averages. But average yields of corn and cotton today are at least 40 percent higher than the averages prevailing from 1901 to 1940. This tends to increase yield variations in terms of bushels or pounds per acre. On the other hand, improved technology appears to have reduced yield fluctuations somewhat when measured as a percentage of the current trend level. To balance these two effects, the yield deviations for each year 1901 through 1950 were adjusted in such a way as to give equal weight to the actual variation (measured in pounds or bushels) and to the percentage variation applied to current normal yields.[1] (See fig. 1.)

[1] That is, the following estimates are based on a series of adjusted yield variations, calculated from the actual yield record for the years 1901 through 1950, which weights equally or averages together (*a*) the annual variations in terms of pounds or bushels per acre from a 9-year moving average, and (*b*) the percentage variation from the same 9-year moving average applied to 1952 goal yields which are about equal to, or for corn 2 bushels above, the average for the last 5 years, 1947–51.

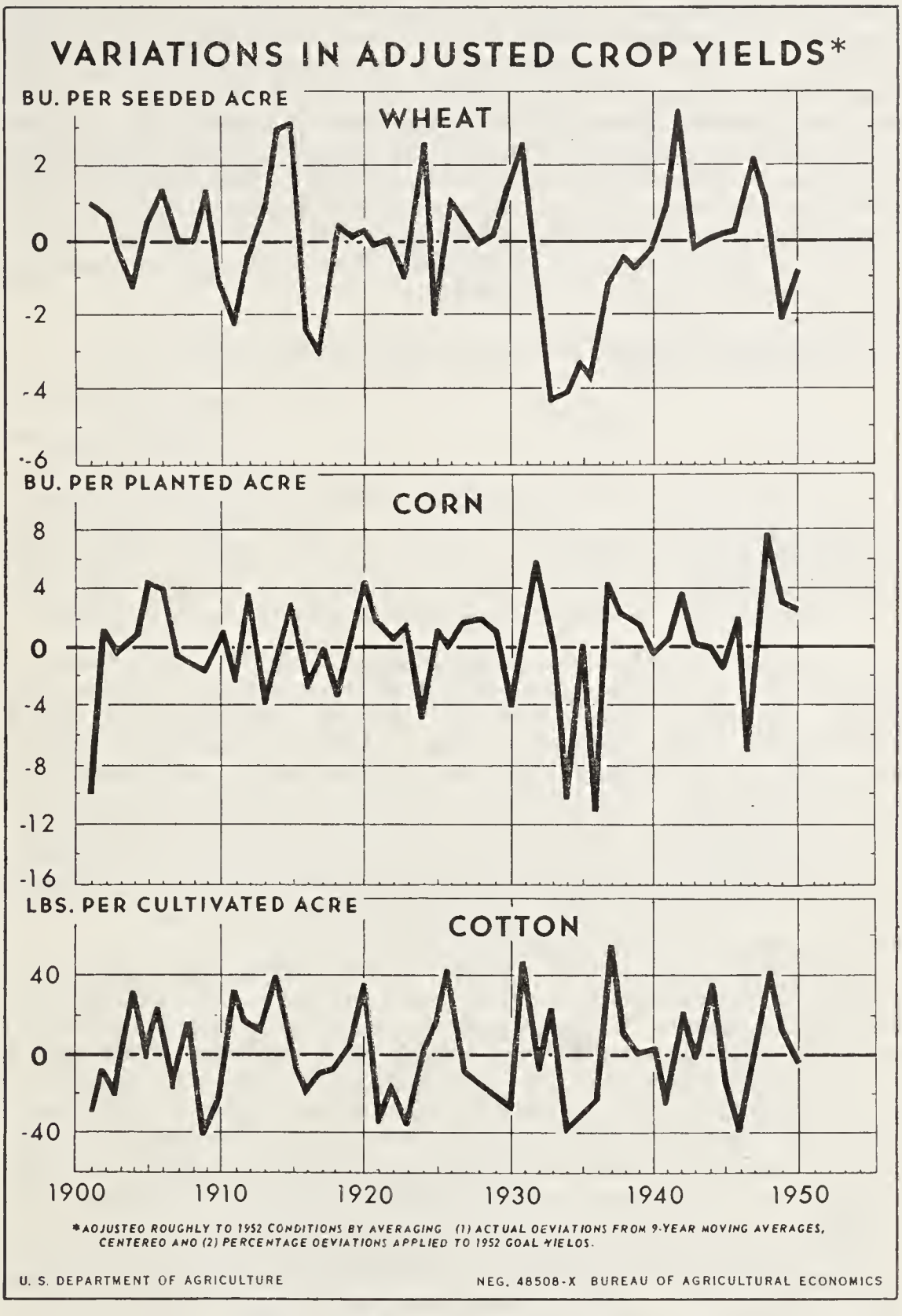

FIGURE 1.—Year-to-year variations in yields of wheat, corn, and cotton are due almost wholly to natural causes. Improved technology has raised the trend or average level of yields in recent years, while probably reducing their variability on a percentage basis. Allowing for these factors, there appears to be about a 50-percent chance that wheat yields will fall within 1 bushel, corn yields 2 bushels, and cotton yields 20 pounds, of the trend level in any given year. But there is also a 10-percent chance that yields will fall below trend by more than 3 bushels for wheat, 5 bushels for corn, and 35 pounds for cotton.

Given these conditions as to requirements and the probable variability of yields, some decision is necessary as to the amount or proportion of the possible maximum yield variability that it might be feasible to offset through storage. After studying the historical variations in yields and consumption of these commodities, we have selected as reasonable the following objective: To offset one very low yield and one moderately low yield in sequence, while maintaining minimum working stocks. For concreteness, a "very low yield" is defined as the average of the 5 lowest yields (adjusted deviations below trend) during 1901–50, and a "moderately low yield" is defined as the average of the 20 next lowest yields. The specific figures resulting from these definitions are as follows:

Yield deviations ranked from largest negative to largest positive, 1901–50

Ranks	Average yield deviation for group		
	Wheat	Corn	Cotton
	Bushels	*Bushels*	*Pounds*
Very low (5 lowest years)	−3.8	−9.0	−39.0
Moderately low (20 below average years)	−.9	−1.2	−16.9
Moderately high (20 above average years)	.7	1.9	14.4
Very high (5 highest years)	3.0	5.5	44.8

At acreages about equal to those planted in 1951, this sequence would mean a 2-year cumulative production deficit of about 375 million bushels for wheat, about 850 million bushels for corn, and a little over 3 million bales for cotton. If yield deviations in successive years were independent of one another, such a sequence would occur about once every 12 years. However, 70 to 90 percent of the 2-year deficit would be due to the one very low yield, which might be expected about once in 10 years. But we do not know that year-to-year variations are entirely independent of one another, especially for wheat, while the probability is that 2 below-average years will occur in sequence about once every 6 years or so.

The accompanying table analyzes in more detail the likelihood of various possible deviations from trend or "expected" yields under current conditions. There appears to be about a 50-percent chance that the United States average wheat yield will turn out within a bushel of the trend, the corn yield within 2 bushels, and the cotton yield within 20 pounds. However, there is about a 10-percent chance that the wheat yield will be 3 bushels or more below trend, the corn yield 5 bushels or more, and the cotton yield 35 pounds or more below trend. Chances for above-average yields are also indicated in table 1.

Wheat.—The worst individual wheat yields (as adjusted) during the 1901–50 period were from 4 to 5 bushels per seeded acre below the trend (fig. 1). At the current level of acreage, a yield as low as this would reduce production by 300 to 400 million bushels (table 1). To cover such a yield deficit in full while maintaining working stocks of 100 million bushels would require a beginning stock of 400 to 500 million bushels.

Except during drought years of the 1930's, only 1 year's yield was low enough to cause a production deficit of as much as 250 million

bushels. There was one sequence of 3 years in which the cumulative production deficit would have slightly exceeded 300 million bushels, and another of 2 years in which the deficit would have exceeded 400 million bushels (table 7, supplement 1). Thus, a carryover of 500 million bushels of wheat would have been sufficient to maintain working stocks and offset in full any individual year and all but one sequence of years of below-average yields during the last half century except during the drought years, 1933–36.

TABLE 1.—*Wheat, corn, and cotton: Frequency distributions of variations in yield and production*

1. WHEAT [1]

Deviations from trend yield [2] (1)	Percent frequency (2)	Equivalent deviations in production [3] (3)
Bushels per seeded acre:		*Million bushels*
Total	100	
−4.9 to −4.0	4	−399 to −320.
−3.9 to −3.0	6	−319 to −240.
−2.9 to −2.0	8	−239 to −160.
−1.9 to −1.0	8	−159 to −80.
−0.9 to 0	24	−79 to 0.
0 to 0.9	26	0 to 79.
1.0 to 1.9	12	80 to 159.
2.0 to 2.9	6	160 to 239.
3.0 to 3.9	6	240 to 319.

2. CORN

Bushels per planted acre:		*Million bushels*
Total	100	
−11.9 to 9.0	6	−1,019 to −765.
−8.9 to −6.0	2	−764 to −510.
−5.9 to −3.0	8	−509 to −255.
2.9 to 0	23	−254 to 0.
0 to 2.9	45	0 to 254.
3.0 to 5.9	14	255 to 509.
6.0 to 8.9	2	510 to 764.

3. COTTON

Pounds per acre in cultivation, July 1:		*Thousand bales* [4]
Total	100	
−44.9 to −30.0	12	−2,624 to −1,750.
−29.9 to −15.0	22	−1,749 to −875.
−14.9 to 0	23	−874 to 0.
0 to 14.9	13	0 to 874.
15.0 to 29.9	14	875 to 1,749.
30.0 to 44.9	12	1,750 to 2,624.
45.0 to 59.9	4	2,625 to 3,499.

[1] 1926–34 average taken as trend for all years 1930 through 1938.
[2] Average of (1) deviations of actual yields from 9-year moving averages, centered, and (2) the corresponding percentage deviations applied to 1952 goal yields of 14.9 bushels per acre for wheat, 37.9 bushels per acre for corn, and 280 pounds per acre for cotton. The 1952 goal yields are considered as trend or normal levels with 1952 production techniques and average weather.
[3] Assuming 80 million seeded acres of wheat, 85 million planted acres of corn, and 28 million acres of cotton in cultivation July 1.
[4] Bales of 500 pounds gross weight (equals 480 pounds net weight of lint).

The cumulative deficiency of wheat yields during 1933–36, applied to the current acreage and yield level, exceeds a billion bushels. But wheat-yield data from 1866 to date includes no other sequence of years as bad as 1933–36, and it certainly does not seem feasible to carry wheat stocks of a magnitude sufficient to meet such a doubtful exigency

in full. In the event of a protracted drought in this country, other exporters and importers would probably make some increases in their own acreages while the quantity of wheat fed to livestock in this country would be sharply cut. Similar steps were taken during the 1930's.

Corn.—The poorest individual yields for corn (as adjusted) were 10 or 11 bushels below trend (table 1 and table 7, supp. 1). In terms of production at current acreage levels, such yields would reduce production by 850 to 950 million bushels below the expected trend level. Deficits as large as this would have occurred with yield deviations as in 1936, 1934, and 1901. The yield deviation of 1947 would have entailed a production deficit of 600 to 625 million bushels.

For a number of reasons it does not seem necessary to offset variations in corn production bushel for bushel. The great bulk of the corn supply is consumed by livestock and there is some flexibility in feeding requirements. Further, despite the fact that corn is the key feed grain, it provides only about one-quarter of the total supply of livestock feeds, including other feed grains, byproduct feeds, hay, range and pasture.

There is another factor, however, which tends to increase corn requirements. Yields of other feed grains tend to fluctuate in the same direction as do yields of corn, so that the variation in total feed-grain production is about 20 to 25 percent larger (in tons or equivalent bushels of corn) than in production of corn alone. To cover this additional source of variation would have required a total carry-over of 900 million to 1 billion bushels of corn plus the equivalent of another 100 million bushels in the form of reserves of other grains in excess of working stocks.

Except during 1934–36 the low individual yields of corn were widely spaced. No sequence of two or three below-average yields aside from 1934–36 would have called for a carry-over of more than 800 to 900 million bushels of corn. However, to cover the 1934–36 sequence in full would have required beginning stocks of corn and other feed grains of close to 2 billion bushels corn equivalent. Again, no other sequence of years during the recorded history from 1866 to date was of equal severity, and it does not seem feasible to carry stocks of the magnitude required to cover such an event.

Cotton.—The worst individual yields for cotton (as adjusted) were 30 to 45 pounds per acre below trend (table 1). At the 1951 acreage, such yields would have meant a production deficit of 1¾ to 2½ million bales. Leaving aside the two worst yield sequences on record, there were several 2- or 3-year sequences which would have involved cumulative production deficits of 2½ to 3¾ million bales, assuming acreages were held at the 1951 level (table 7, supp. 1). Thus, carry-in stocks of 4.5 to 5 million bales, including 2 million for working stocks, would have been adequate to offset somewhere between 80 to 100 percent of such deficits.

The most serious challenges to a cotton-storage program would have arisen from two 3-year sequences of low yields, one associated with the boll weevil invasion (1921–23) and the other with the great drought (1934–36). At the 1952 goal acreage, each of these runs would have involved cumulative production deficits of about 5 million bales. However, the actual effects of these sequences were mitigated by increases in acreage, particularly in the third year. With yields 40 pounds per acre below the current average, an increase of 1 million

acres in the second year and 1 million more in the third would increase the 3-year total production by about 1½ million bales and reduce the cumulative deficit to about 3½ million bales.

SUMMARY OF YIELD VARIATIONS

In summary, it appears that working stocks could be maintained and the effects of one very low and one moderately low yield in sequence offset with carry-over stocks of about 450 to 500 million bushels of wheat, 4.5 to 5 million bales of cotton, and 900 to 1,000 million bushels of corn, supplemented by moderate quantities of the other feed grains (probably not more than 100 million bushels of corn equivalent beyond working stocks). Carry-overs of this size would provide adequate protection against all but the worst weather contingencies in our recorded history, assuming acreages were held at about their current level.

VARIATIONS IN DEMAND

Normal variations.—If demand falls when prices are at or close to the loan or price-support level, larger quantities of storable crops are offered under the loan programs; when demand increases, the Commodity Credit Corporation (hereinafter referred to as CCC) releases its stocks within the United States at prices moderately above the support-price level. Under current arrangements these more or less automatic adjustments occur in response to changes in domestic demand. Changes in export demand also lead to similar adjustments even though the CCC has authority to sell Government-owned stocks for export at less than the support level.

Unlike crop yields, demand changes definitely do not occur in random sequences, but rather tend to move in the same direction for two or more years at a time. Year-to-year changes in domestic demand for wheat and corn (measured by the quantities which would be utilized at unchanged prices) have been much smaller on the average than year-to-year changes in their production. During 1922–41 the combined year-to-year variation in the demand for and production of corn could have been offset with stocks little larger than those needed to offset yield or production variations alone. A still smaller allowance would have been needed to offset variations in the domestic demand for wheat although exports have varied greatly. In the case of cotton, year-to-year variations in domestic demand at the mill level have been substantial and export demand has also fluctuated widely.

Cumulative swings in demand from peak to trough of a business or livestock-feeding cycle may be much larger than the maximum change in demand from one year to the next. Meanwhile, stocks of storables can be very useful in allowing adjustments to these swings in demand. From the standpoint of building and maintaining a market for farm products, reserve stocks allow the effective demands of users or consumers, both domestic and foreign, to be more surely and immediately met than will dependence on increasing acreages, which involves not only a considerable time lag but also the 50–50 chance that below-average yields will further delay the ability to increase marketings. On downswings, a strong storage program can also be very useful in

conserving supplies or maintaining efficiency. That is, very low prices in the past, for grains especially, have resulted in many instances in increasing waste and inefficient feeding practices—situations which dissipate resources and benefit no one. Storing surplus stocks under such circumstances not only conserves resources and supports market prices at the time but also enables farmers to better meet future increases in demand.

Defense-related considerations.—The use of stocks to meet the initial shock of war or defense mobilization has now been demonstrated twice within the last decade, once following our own entry into the war in 1941 and again following the outbreak of hostilities in Korea in June 1950.

It is of course not feasible to build and carry reserves, grain reserves especially, large enough to assure that all effective demands can be met in case of a major war. But certainly our experience following both 1941 and 1950 indicates the value of farm-commodity reserves in controlling inflation and defense planning, even though major reliance in any long-continued war or mobilization emergency must chiefly rest on building up our basic capacity to produce in agriculture as well as in other sectors of the economy. Yields are just as likely to vary during defense or mobilization emergencies as during peacetime, while the need for protection is obviously increased.

MAJOR POLICY QUESTIONS

The preceding sections have dealt chiefly with the technical problem of estimating stocks needed to offset specified variations in yields and demand. Decisions as to the levels of stocks which are to be carried as a matter of national policy must be made by the Congress and, so far as Executive discretion is allowed, the appropriate policy officials of the executive branch, with due regard to their effects upon farmers, marketing agencies, and consumers. The decision to carry stocks of a given magnitude depends, implicitly or explicitly, upon the answers to a number of related policy questions. It is not the purpose of this report to answer these questions but rather to state them and supply some of the relevant facts. The questions are:

Who carries the stocks?—Ordinarily, farmers carry over practically no cotton and very little wheat at the end of a marketing season. Farmers do carry sizable quantities of corn over from a bumper crop. But year-end farm stocks of old corn (other than those under CCC loan) have never much exceeded 300 million bushels (327 million on October 1, 1933). Privately held off-farm stocks at the end of a marketing year have normally included around 50 million bushels of corn and 100 million bushels of wheat.

Stocks of cotton privately held in the United States exceeded 6 million bales in 1921, following the sharp recession starting in 1920, and 7 million bales in 1932. But the period 1922–29 would appear to be more representative of the level of stocks held privately under normal conditions and in the absence of Government programs. During this period carry-overs (farm and nonfarm combined) averaged about 2.4 million bales of cotton, 125 million bushels of wheat, and 175 million bushels of corn. The maximum carry-overs during 1922–

29 were about 3.7 million bales of cotton, 227 million bushels of wheat, and 280 million bushels of corn.

It seems clear that if stocks of the magnitudes needed to offset yield variations are to be carried, substantial portions of them will often have to be carried with Government aid. In fact, under some circumstances the existence of Government price-support and storage programs reduces the level of stocks which private individuals and firms are willing to carry. This is likely when both market and support prices are expected to decline. However, the reverse is also true: there are occasions when a strong support program also encourages private individuals to hold stocks on stronger terms, especially price-wise.

Where will they be stored?—In general, reserve stocks whose ultimate destinations are uncertain are stored close to the point of production or along the main flow routes out of major producing areas. In each of the past 9 years all but 40 to 60 million bushels of the corn carry-over has been located in the North Central States, the Corn Belt. A large part of the wheat carry-over has been located in or on the edges of the main surplus-producing areas. Sizable amounts of wheat and cotton can be stored at some distance from the point of production provided that they remain "in position" along the principal channels of domestic or export movement.

Aside from geographical location as such, there is the additional question as to whose facilities shall be used for storage. Substantial quantities of corn under the CCC loan program are stored on farms. Currently, large quantities of corn are also wholly owned by CCC and are stored within the main producing area in steel bins located at or near railroad facilities. Farm storage is much less important in the case of wheat and negligible in the case of cotton.

Congress has indicated that the CCC should use private facilities "to the maximum extent practicable" in its price-support and storage programs. The CCC does chiefly use private facilities but has also found it necessary to provide grain-storage facilities with a total capacity of 544 million bushels. The central importance of the marketing function often imposes limits on the quantities of grain that can be stored in particular commercial facilities. Many grain elevators are not set up to provide "dead storage" for extended periods. Their major function has been in the marketing of the wheat and other grain crops, and this may involve turning their stocks several times during the course of a marketing season.

Existing off-farm grain-storage capacity as of 1951 is summarized in table 2. Some of the commercial capacity is used for rice, dry beans and peas, field seeds, flaxseed and soybeans in addition to wheat and feed grains. Also, grain elevators need some part of their rated capacity for working space. Allowing for these deductions, it is still apparent that existing facilities (including CCC facilities) are generally adequate to handle sizable carry-overs and, at the same time, to market new grain crops of normal size. However, a sequence of bumper feed-grain crops in one year followed by a bumper wheat crop in the next would put a severe strain on off-farm storage facilities in some areas. Some areas may still need additional commercial facilities but the more widespread need is for improved storage facilities.

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TABLE 2.—*Capacity of off-farm-grain-storage facilities by groups of States, United States, 1951*

[Millions of bushels]

Area	Commercial off-farm-grain-storage capacity [1]			Storage capacity owned by CCC [2]
	Bulk	Sack or unidentified types	Total commercial	
	(1)	(2)	(3)	(4)
1. Major wheat-storage areas [3]	1,142	66	1,208	218
2. Major corn-storage areas [4]	399	18	417	319
3. All other States	395	156	551	7
United States	1,936	240	2,176	544

[1] Includes some capacity used for rice, dry beans and peas, field seeds, flaxseed, and soybeans.
[2] Commodity Credit Corporation.
[3] Colorado, Idaho, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Washington.
[4] Illinois, Indiana, Iowa, Ohio. Significant quantities of corn and other feed grains are stored in some of the States listed in footnote 3.

Comparable estimates of grain-storage capacity on farms are not available. Corn is generally stored in cribs on the farm, while even simpler facilities are improvised to handle bumper crops despite the fact that this may involve greater than average loss or deterioration. Judging from the maximum quantities of small grains previously stored on farms in each State, there appears to be over 2 billion bushels of farm storage for grains other than corn. This should allow adequate space on most farms for handling normal crops of feed grains other than corn—oats, barley, grain sorghums—along with sizable carry-overs.

With respect to farm storage generally, the Congress has indicated that the CCC should make loans to farmers needing storage facilities in order "to encourage the storage of grain on farms, where it can be stored at lowest cost." On many farms additional storage for corn and small grains can be provided at relatively low cost.

While the storage situation would need watching when crops were large and carry-overs high, adequate commercial grain-storage facilities are generally available at the present time while additional farm-storage capacity is being gradually added. If steel were freely available, large quantities of additional bin capacity could be constructed, if needed, on relatively short notice. A temporary strain could be alleviated to some extent by accelerating wheat exports before and during the harvest season and by making fuller use of facilities in deficit areas. Cotton-warehousing capacity is more than adequate to carry probable cotton stocks for the next few seasons, except possibly in the Far West.

How much will it cost, and who pays?—Charges paid by CCC for the use of private storage facilities are specified in uniform grain storage and warehousing agreements. For the 1951–52 season, storage charges on corn and wheat are one-twentieth cent per bushel per day up to a maximum of 200 days, except for wheat in certain areas where the maximum ranges from 215 to 230 days. No charge is made for the remainder of the year. Thus, the annual charge for grain storage (as distinct from receiving and loading out) is 10 cents per bushel,

except for wheat in the specified areas, where it will range from 10¾ to 11½ cents.

Costs of storing corn and wheat in Government-owned steel bins cannot be precisely calculated, as the period over which the cost of the bins will be amortized and the average number of bushels which will be stored in them cannot be accurately forecast. Direct costs of inspecting, fumigating, and otherwise caring for the stored grain are estimated currently at about 5 cents per bushel per year. The initial cost of steel bins per bushel of capacity, including costs of erection, has averaged about 22½ cents, so that amortization over a 10-year period would amount to a little over 2 cents per year per bushel of capacity. If bins were used to less than capacity, the overhead charge would amount to something more than this, assuming 10-year amortization.

Under its 1951 program, CCC pays 35 or 40 cents per bale per month for storage of cotton in private warehouses. The lower rate applies to cotton stored in warehouses operating compress facilities. Thus, the annual charge for storage is about 1 cent a pound.

Storage and warehousing charges are only a part of the cost or burden of carrying stocks. Moreover, under any circumstances a large part of the immediate storage and handling charges are borne directly by private individuals. Working stocks are carried by the private trade as well as some speculative stocks, while farmers carry the storage costs or charges on their corn and wheat loan stocks until possession is actually turned to the CCC. In the case of cotton, producers also carry the storage charges in case their loans are redeemed and may or may not carry them in case the CCC takes possession depending on the outcome of the pooling arrangements under which such cotton is handled.

The broader question relates to the Government investment in loans and stocks and the probable chances that the future market may or may not be strong enough to cover the initial loan rates plus carrying charges and other costs. That is, the final costs to the Federal Treasury of storage and price-support operations on the main storable crops depend upon market conditions and the policies followed in releasing Government-owned stocks for sale.

In the past CCC has incurred virtually no losses on the commodities considered in this report. For the future, also, the final costs to the Government for carrying, or assisting in carrying, stocks of the main storable farm commodities may continue to be negligible, or at least relatively small. Purchasers of the stored commodities will presumably pay all or most of the direct costs of storage in return for the greater benefits of having adequate supplies in years when production is small or demand high. Attention is also called to the fact that, as a public-service corporation, CCC has foregone large potential profits on several occasions in the interest of economic stability—notably in the early years of World War II and following June 1950.

To what extent does storage policy stabilize the economy, and who benefits?—Producers have a number of interests in maintaining stable supplies of farm products. If it is desired to hold or increase export markets, the longer-run interest of wheat and cotton producers makes it advisable to meet normal export demand for their commodities in full or certainly in substantial part even in years of short domestic crops. If the United States producers are not able to meet effective

export demands, there is an incentive on the part of importing countries to increase their own production and to arrange for increased supplies from other exporters. The high prices associated with inadequate United States supplies also stimulate production in other exporting countries, especially if such a situation continues for several years. In the case of cotton, high prices or short supplies provide an incentive for textile manufacturers both here and abroad to extend their use of synthetic fibers. Such shifts to synthetics have proved to be only partially reversible.

Corn is primarily a feed crop. The greatest fluctuations in corn yields have occurred in the western Corn Belt, which is our major surplus-producing area for livestock products. The droughts of 1934 and 1936 caused severe hardship to livestock producers in this region. Many were forced to liquidate breeding herds, and the resulting disruption in their livestock programs required several years to repair. Livestock producers in feed-deficit areas are adversely affected by short corn supplies in two ways: Their out-of-pocket cost for purchased feed is increased sharply, and the physical shortage of supplies forces unwanted adjustments in their production programs. Most livestock producers have a substantial fixed investment in land, buildings, and equipment directly connected with their livestock enterprises, and it is not economical for them to shift in and out of livestock production, or to vary the level of livestock production sharply from year to year. Adequate reserves of feed grains can materially assist in providing needed stability to livestock producers in all areas.

United States consumers are little affected by minor variations in supplies of wheat and cotton, partly because domestic use can be maintained by reducing exports. Also, the farm prices of wheat and cotton amount to only about 15 percent, or one-sixth, of the equivalent retail value of their products. As for corn, a given variation in the amount of grain fed to livestock produces a smaller percentage variation in the output of livestock products. Production of beef cattle, lambs, and milk depends largely upon hay and range or pasture. Hog production, however, has been extremely vulnerable to changes in corn supplies. While moderate variations in corn supplies may not seriously affect the total supply of livestock products, they can considerably affect the cost of dairy and poultry rations and the level of pork production. Substantial deficits seriously affect both farmers and consumers on a Nation-wide basis.

Under wartime conditions, consumers are particularly vulnerable to reductions in food supplies which might result from inadequate feed reserves. Unless supplies can be maintained or probably increased, price controls and rationing are almost inevitable, and the impact of rationing falls with greatest severity upon those consumers who are farthest from sources of supply. A short feed supply in the event of war would cause severe distribution problems and might threaten the nutritional status and morale of many families in urban or industrial centers. Adequate supplies are also the greatest single factor in making price control work.

What effects will stocks have upon farm prices?—In the absence of strong price supports, large stocks tend to depress farm prices, usually by more than a proportionate amount. Some commodity markets were completely demoralized in the early 1930's by large, unwanted stock accumulations in the face of declining demand. Such experi-

ences have contributed to a fear of stocks on the part of many producers, clearly emphasizing the importance of regulations and legislative provisions relating to the manner in which such stocks are to be carried and released.

Before the establishment of a price-support program, all stocks were available to the market on the same terms as current production, regardless of the level to which prices might fall. But the case is different when part of the stocks are held subject to definite limitations on resale.

The price effect of stocks under loan or in CCC ownership depends upon the conditions under which those stocks are held. For example, if CCC is prohibited from selling corn at less than $1.80 a bushel, and if farmers and the trade accept this as a firm situation, its stocks are not a part of the market until the price reaches or exceeds that level. Similarly, if farmers can fairly easily turn their stocks over to CCC at a prescribed loan rate, these stocks are not generally a part of the market until the price rises above the loan rate. Clearly, the effects of farm and CCC stocks upon prices can be controlled to a very considerable extent by specifying the loan levels, producer privileges, and release policies which shall be applied.

How does storage policy tie in with the current agricultural situation?—Primary emphasis was given in an earlier section to estimating stocks needed to offset one or more years of low yields. Obviously, such stocks would not ordinarily be on hand at the end of a drought year, since the main objective of storage is to meet such contingencies. But once stocks are depleted, how and when are they to be rebuilt?

Carry-over stocks of corn, wheat, and cotton at the end of the current marketing season will all be well below the levels discussed earlier. In short, the current problem is one of maintaining or rebuilding stocks, and it must be viewed against the background of prospective supplies and requirements during the years immediately ahead.

Consider the current relation between the production and requirements for farm products. The disposable income of consumers is at a record level both in dollar terms and in terms of the total amount of goods and services which it will purchase. The export demand for cotton, wheat, and corn is also at high levels. The over-all utilization of United States food products by civilians, the armed forces, and importing countries in 1951 was at a record peacetime rate and only a little below the wartime record of 1944. Livestock production and feed consumption are also close to the World War II peak.

During the 1951–52 marketing season, total disappearance of corn is estimated at over 3.2 billion bushels, of wheat at about 1.1 billion bushels, and of cotton at about 15.5 million bales. These estimated disappearance rates are all larger than 1951 production. Harvests in 1951 amounted to 2,941 million bushels of corn and 987 million bushels of wheat. The 1951 cotton ginnings of only a little more than 15 million running bales, supplemented by normal imports of about 0.2 million bales, are also under the estimated disappearance.

The 1952 production goals call for 89 million planted acres of corn, almost 78 million seeded acres of wheat, and 28 million acres of cotton in cultivation as of July 1. These acreages are all considered to be close to the maximum that we might expect to attain in 1952 or to maintain on a continuing basis thereafter.

For the duration of the mobilization program, a relatively well-sustained demand for most goods and services, including most staple farm products, should be assured. Certainly it is not safe to plan on anything less until conditions have actually changed. But if requirements continue at or close to current levels, the immediate prospect of substantially adding to stocks of corn and cotton especially is not overly favorable, depending chiefly upon above-average yields.

Preliminary indications for the 1952 winter-wheat crop are favorable, and a relatively large acreage will likely be seeded to spring wheat. Some feed wheat will also probably be imported from Canada during the current calendar year. On the basis of present estimates of wheat supplies and distribution, the carry-over on July 1, 1952, will be about 270 million bushels, but with current yield prospects (as of April 1952) the carry-over on July 1, 1953, could well run 450 million bushels or more.

In the case of cotton, the goal production for 1952, if realized, would perhaps allow an increase of a half-million bales or so in year-end stocks between August 1, 1952, and August 1, 1953. But this is a fairly close calculation, especially when one takes into account the uncertainties which are always present as to future acreages, yields, domestic consumption, and export demand.

The prospects for immediately accumulating additional stocks of corn are also doubtful. If the effective demand for livestock products continues at the current level per person, population growth alone will call for a gradual increase in corn requirements—about 50 million bushels a year between now and 1955 unless offsetting efficiencies are achieved in livestock feeding. The goal acreage for 1952 is higher than the actual corn acreage in any of the preceding 5 years and, on the basis of normal yields, it is doubtful if a production of more than 3,300 million bushels can be expected in 1952. Such a production would certainly not be much above expected requirements for the coming feeding year starting October 1. For the next year or two, therefore, the chances of accumulating additional corn stocks depend chiefly upon above-average yields or a cut in livestock production.

These considerations indicate that any special stockpiling as a part of the defense program would for the most part simply be an earmarking of stocks already on hand or in sight. It is true, of course, that yields substantially above average or a substantial slackening in export or domestic demand could result in increases in stocks above levels indicated above on the basis of average yields and the current economic outlook. On the other hand, the American population is increasing and production and yields per acre of the main crops will need to continue to trend upward over the years ahead.

The fact that we are currently exporting relatively large quantities of cotton and wheat does provide a considerable margin of protection for domestic consumers, but the assumption that exports can be cut to maintain domestic uses also calls for consideration as to whether this is the wisest course both from the standpoint of farmers and the national interest. And, in the case of corn and the other feed grains, exports account for only a small part of our United States production.

In summary, our agricultural economy is now functioning at close to top speed within the limits of present techniques and incentives. Total farm output in 1951 was at or near a record level, and the production goals for 1952 call for an increase of 6 percent over 1951.

But, as indicated above, no substantial increase in either corn or cotton stocks or reserves are likely during the coming year unless above-average yields are realized. Above-average yields would probably result in a substantial increase in wheat stocks and current indications are that such yields may be realized.

EXISTING LEGISLATION RELATIVE TO STORAGE

Current legislation affecting storage includes provisions relating to acreage allotments, marketing quotas, and support price levels; and standards for the conduct of storage and price-support programs, including the release of Government-held stocks.

Marketing quotas and acreage allotments.—Current legislation specifies certain maximum stock or supply levels at which marketing quotas become mandatory. Proclamation of marketing quotas becomes mandatory when the "total supply" exceeds the "normal supply" by 20 percent for wheat or corn and when the total exceeds the normal supply for cotton.

The "normal supply" of wheat and corn for a given marketing year is defined as the previous marketing year's estimated domestic consumption, plus estimated exports for the given year, plus a specified allowance for carry-over. For cotton the "normal supply" is equal to the estimated domestic consumption and exports for the given marketing year to which the determination applies, plus an allowance for carry-over. The normal carry-over allowances are 15 percent of total disappearance in the case of wheat, 10 percent in the case of corn, and 30 percent in the case of cotton.

For concreteness, the normal supply levels and the levels at which marketing quotas become mandatory are indicated in table 3, assuming disappearance and production of each commodity about in line with current conditions.

The implied stocks at which proclamation of marketing quotas becomes mandatory are fairly close to reserve or stock levels indicated earlier in discussing stocks needed to offset specified yield variations—418 million bushels of wheat as compared with the 450 to 500 million bushels indicated in the yield analysis, 1.06 billion bushels of corn as compared with 900 million to 1 billion bushels, and 4.65 million bales of cotton as compared with 4½ to 5 million bales. But when marketing quotas are applied to corn and cotton they are to be set at such levels as would (with average yields) reduce total supply to the normal supply level. Under the disappearance assumptions in table 3, which are approximately in line with current conditions, this means that the cotton carry-over allowance would continue at 4.65 million bales. However, the carry-over allowance or implied goal for the corn carry-over, assuming average yields, is reduced to 330 million bushels. The marketing quota for wheat would (at average yields) result in a total supply equal to 130 percent of a normal year's domestic consumption and exports and, based on the indicated requirements, this would indicate a 330-million-bushel carry-over allowance.

Minimum support prices.—The Agricultural Act of 1949 provides that wheat, corn, and cotton are to be supported at 90 percent of parity provided that the estimated total supply is not more than 102 percent of normal supply in the case of wheat and corn, and not more than 108 percent in the case of cotton. Beyond these points, the

minimum prices at which support is mandatory are reduced with increasing supplies, reaching the absolute minimum level of 75 percent of parity when the supply percentages exceed 130. However, for any crop for which marketing quotas have been disapproved by producers the support price is to be reduced to 50 percent of the parity level.

TABLE 3.—*Normal supplies and allowances for stocks under current legislation, at assumed levels of crop production and disappearance*

Commodity	Unit	Normal supply [1]			Supply at which proclamation of marketing quotas becomes mandatory	Implied level of stocks at which proclamation of marketing quotas becomes mandatory [2]	Implied target level of stocks when allotments and quotas are applied [2]
		Total disappearance	Carryover allowances	Total (1)+(2) [1]			
		(1)	(2)	(3)	(4)	(5)	(6)
Wheat	Million bushels	1,100	165	1,265	1,518	418	330
Corn	do	3,300	330	3,630	4,356	1,056	330
Cotton	Thousand bales	15,500	4,650	20,150	20,150	4,650	4,650

[1] Not official; based on rounded estimates of consumption and exports approximately in line with current conditions.
[2] Assumes production equal to disappearance in column (1).

The maximum level of support for wheat, corn (within the "commercial area"), and cotton is 90 percent of parity regardless of the level of supply, except when it is determined by the Secretary of Agriculture, after a public hearing, that a higher support is necessary to prevent or alleviate a shortage of a commodity essential to the national welfare or to increase or maintain the production of a commodity in the interest of national security. In exercising his discretionary authority to support prices above the minimum levels, the Secretary of Agriculture must take certain factors into consideration. Currently, the Secretary has announced that the 1952 crops of wheat, corn, and cotton will be supported at 90 percent of parity.

Standards for acquisition and release of stocks.—To a considerable extent, the acquisition of supplies of corn, wheat, and cotton is a byproduct of the mandatory provisions for price-support loans to eligible producers. Eligibility for price-support loans is contingent upon compliance with acreage allotments when these are in effect.

There are also limitations on the prices at which the CCC can release stocks acquired under the price-support program. Specifically, the Corporation is prohibited from selling any basic agricultural commodity or storable nonbasic commodity at less than 5 percent above the current support price of such commodity, plus reasonable carrying charges, subject to certain exceptions, as follows: (*a*) Sales for new or byproduct uses; (*b*) sales of peanuts and oilseed for extraction of oil; (*c*) sales for seed or feed if such sales will not substantially impair any price-support program; (*d*) sales of commodities which have substantially deteriorated in quality or when there is danger of loss or waste through deterioration or spoilage; (*e*) sales to establish claims arising out of contract or against persons who have committed fraud, misrepresentation, or other wrongful acts with respect to the commodity; (*f*) sales for export; (*g*) sales of wool; and (*h*) sales for other than primary uses.

The CCC is not required to sell all of its stocks at the prescribed resale level. In most cases CCC has sold its stored commodities freely

at market prices when the latter were at or above the minimum resale price. But there have been and are exceptions. For example, sales of corn are currently subject to certain administrative restrictions relating to the eligibility of purchasers and amounts which can be purchased.

Use of private storage facilities.—The Commodity Credit Corporation Charter Act grants the Corporation authority to acquire real property or any interest therein for the purpose of providing storage to carry out its programs, but provides that this authority shall not be utilized to provide storage facilities when existing privately owned facilities in the area concerned are adequate. The charter act also requires that the Corporation shall—

> to the maximum extent practicable consistent with the fulfillment of its purposes and the effective and efficient conduct of its business, utilize the usual and customary channels, facilities, and arrangements of trade and commerce in the warehousing of commodities.

Further the charter act provides:

> That to encourage the storage of grain on farms, where it can be stored at the lowest cost, the Corporation shall make loans to grain growers needing storage facilities when such growers shall apply to the Corporation for financing the construction or purchase of suitable storage, * * *.

II. Supplements

SUPPLEMENT 1.—HISTORICAL VARIATIONS IN CROP YIELDS AND PRODUCTION

Production is the resultant of acreage and yield per acre. Acreage planted is, in a strict sense, subject to direct control. In the absence of Government programs, each producer allocates his acreage to different crops on the basis of economic and other considerations. Acreage allotments and marketing quotas have been used at times to effect sharp reductions in acreages of cash crops such as wheat and cotton. At other times, price supports and production goals have been used to encourage increased plantings.

Year-to-year changes in crop yields are not, as a practical matter, subject to any very precise control. Irrigation, insecticides, drought- and disease-resistant varieties, and improved cultural practices have all helped to reduce yield variation. Nevertheless, variations in the amount and timing of rainfall and temperature, and in the timing and severity of frost, still cause dramatic changes in yields from year to year. For example, corn yields dropped nearly 25 percent from 1946 to 1947, and then jumped over 50 percent from 1947 to 1948. Crop yields remain the most important source of variation in our carry-over stocks and the one least susceptible to human control.

Variations in crop yields.—Wheat, corn, and cotton have Nation-wide markets. From the standpoint of meeting national requirements, our interest centers on total production and average yields for the United States as a whole. Variations in yields by States or regions are of secondary, though by no means negligible, importance in this context.

In projecting the historical variability of United States average yields into the future, however, we should be aware of various factors which might be making for change. On each acre or farm the basic yield variability will depend on the weather, insect, and other hazards

of its location, and also upon the seed varieties and cultural practices being used at any given time. If acreage is extended into areas with high weather risks, this fact tends to increase the variability of United States average yields.

If acreage is expanded on irrigated land or in areas with below-average weather hazards for a given crop, the variability of its United States average yield is reduced. Finally, if cultivation of a crop is extended from a concentrated belt into distant areas where weather conditions are independent of those in the central belt, the variability of the United States average yield may be reduced even though yield variability within the new areas is fully as great as in the old one. This is the well-known insurance principle of "spreading the risk."

Improved varieties and cultural practices have brought striking increases in the average level of crop yields on given pieces of land. The biggest increases have resulted from such things as hybrid seed and heavier use of fertilizer, which increase the maximum outturn to be expected under almost any weather conditions. These changes do not necessarily reduce the variability of yields in either percentage or absolute terms.

Other improvements have reduced specific hazards in particular areas without affecting the other causes of yield variation. Some of these improvements might raise yields only in years when specific hazards were operative. That is, they might reduce the likelihood of very low yields without increasing that of very high yields. In this case, the primary effect of the improvement would be to reduce yield variations. Percentagewise, the increase in average yields over a period of years would be much smaller than the reduction in variability.

It would be a major research task to bring together all the scattered information concerning factors affecting the yield variability of major crops in all areas and under all applicable cultural conditions. In this report we shall work directly with United States average yields for wheat, corn, and cotton during the years 1901 through 1950. The basic geographical pattern of each crop has been fairly stable over this period, although great changes in cotton acreage have occurred in individual States. Hence, it is reasonable to assume that the weather risks confronting these crops over the next few years will be substantially the same as those of 1901 to 1950.

There remains a question as to what adjustments, if any, should be made in the historical data to take account of technological developments some of which have quite clearly reduced the yield variability of some crops in some areas. Average yields of corn and cotton at present are at least 40 percent above the levels prevailing from 1901 to 1940. If we apply the percentage yield variations of that period to the present yield level, we increase the absolute deviations (in bushels or pounds) by over 40 percent. Conversely, if we appraise future yield variability in terms of the bushel and pound deviations of earlier years, we imply that the percentage variability in the future will be about 30 percent less than during 1901 to 1940. In the case of wheat, United States average yields today are only 10 or 15 percent above levels prevailing 25 to 50 years ago. Therefore, it makes much less difference whether we express yield variability for wheat in percentage or absolute terms.

Figure 2 compares actual yield deviations (measured from 9-year moving averages) during 1901–50 with adjusted values obtained by

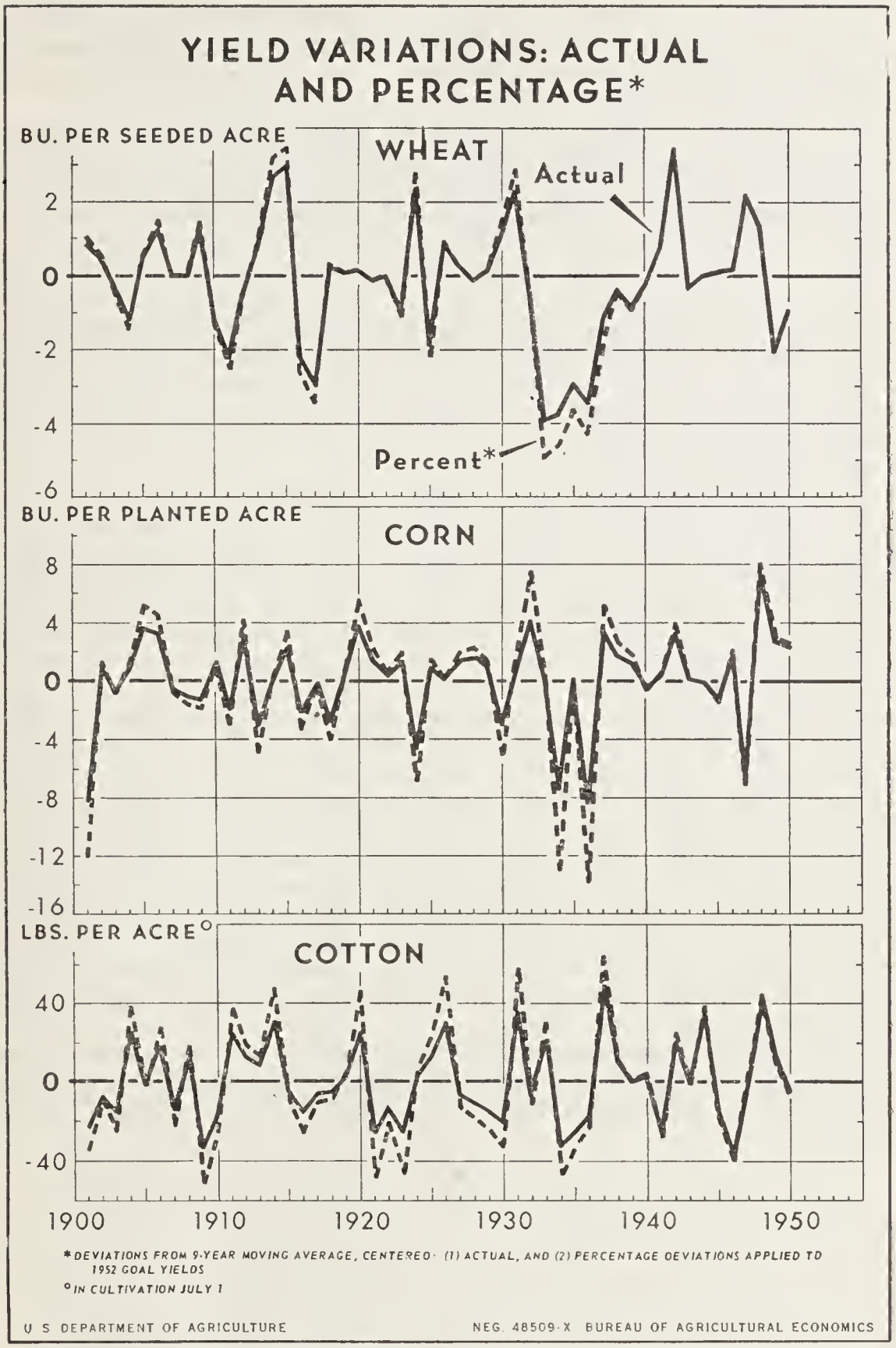

FIGURE 2.—The average level of wheat yields in recent years has been only moderately higher than the levels prior to 1930. But yields of corn and cotton are now 40 to 50 percent above the levels prior to 1930 or 1940. If yield variations remain constant in percentage terms we might experience corn yields as much as 13 bushels per acre below trend and cotton yields of as much as 50 pounds below trend. In contrast the maximum actual deviations were 8 to 9 bushels for corn and about 35 pounds for cotton. The difference between these absolute and percentage deviations would be quite significant for the level of reserves needed to offset a "very low" yield.

multiplying the percentage deviation in each year by the yields assumed in connection with the 1952 United States Department of Agriculture production-goals program. As just indicated, there is little difference between the two series for wheat.

For corn, the change from 1947 to 1948 (unadjusted) is greater than any other unadjusted swing, including 1936 to 1937 and 1932 to 1934. This suggests that the deviations prior to 1940 require some upward adjustment to allow for the present higher absolute level of yields. On the other hand, when the full percentage adjustment is made, the 1947–48 swing is exceeded substantially by 1936–37 and 1932–34, and moderately by 1901–5. For the smaller variations there is little to choose between the adjusted and the unadjusted data. If the adjusted and unadjusted series are averaged, the three major swings prior to 1940 all fall within 1 bushel, or 6 percent, of the 1947–48 change. This averaging is equivalent to an assumption that the basic percentage variability of corn yields today is about 15 percent less than it was during 1901–40.

The unadjusted changes in cotton yields from 1944 to 1946 and from 1946 to 1948 were considerably larger than any other short-run change except that from 1934 to 1937, which itself occurs in the last third of the 50-year series. This suggests the need for upward adjustment in the absolute deviations for years prior to about 1940. If the full percentage adjustment is made, the 1946–48 swing is clearly exceeded by six changes prior to 1940, and is rivaled by three more. A simple average of the adjusted and unadjusted series leaves the 1934–37 change larger than that of 1946–48 and four other swings prior to 1940 about the same size as that of 1944–46. This averaging is equivalent to an assumption that the basic percentage variability of cotton yields today is about 15 percent less than it was prior to 1940.

The basic data for figure 2 are presented in table 4. Table 5 summarizes the three measures of variability for each crop in the form of frequency distributions. The differences between the three measures may be further summarized in terms of the average yield deviations taken without regard to sign (table 6). The average of actual and percentage deviations during 1901–50 as a whole is 94 percent of the 1952 goal-adjusted percentage deviations for wheat, 85 percent for corn, and 85 percent for cotton.

The remaining discussion of yield variability will be based on the "averaged" deviations in columns (3), (6), and (9) of table 4, and the corresponding percentage frequency distributions in column (4) of table 5.

TABLE 4.—*Wheat, corn, and cotton: Alternative measures of yield variation, United States, 1901–50*

Crop year	Wheat (bushels) [1]			Corn (bushels) [2]			Cotton (pounds) [3]		
	Actual deviations	Percentage deviations times 1952 goal yields [4]	Average of actual and percentage deviations	Actual deviations	Percentage deviations times 1952 goal yields [5]	Average of actual and percentage deviations	Actual deviations	Percentage deviations times 1952 goal yields [6]	Average of actual and percentage deviations
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1901	0.9	1.1	1.0	−8.3	−12.1	−10.2	−23.5	−35.0	−29.2
1902	.5	.6	.6	1.0	1.4	1.2	−6.6	−9.8	−8.2
1903	−.4	−1.5	−.4	−.6	−.8	−.7	−15.7	−24.4	−20.0
1904	−1.2	−1.4	−1.3	.8	1.1	1.0	25.1	38.4	31.8
1905	.5	.6	.6	3.7	5.3	4.5	−1.3	−2.0	−1.6
1906	1.3	1.5	1.4	3.3	4.5	3.9	17.5	27.2	22.4
1907	0	0	0	−.6	−.8	−.7	−14.5	−22.1	−18.3
1908	0	0	0	−1.1	−1.5	−1.3	12.1	18.2	15.2
1909	1.3	1.5	1.4	−1.3	−1.9	−1.6	−34.0	−51.5	−42.8
1910	−1.1	−1.3	−1.2	1.0	1.4	1.2	−17.7	−26.3	−22.0
1911	−2.2	−2.5	−2.4	−2.0	−3.0	−2.5	24.6	37.0	30.8
1912	−.4	−.5	−.4	2.9	4.3	3.6	12.2	18.5	15.4
1913	.7	.8	.8	−3.2	−4.8	−4.0	8.2	12.6	10.4
1914	2.7	3.2	3.0	0	0	0	30.7	47.0	38.8
1915	3.0	3.5	3.2	2.3	3.5	2.9	−5.8	−9.0	−7.4
1916	−2.2	−2.6	−2.4	−2.3	−3.4	−2.8	−16.1	−25.5	−20.8
1917	−2.9	−3.4	−3.2	−.1	−.2	−.2	−6.3	−10.4	−8.4
1918	.3	.4	.4	−2.8	−4.1	−3.4	−5.4	−9.2	−7.3
1919	.1	.1	.1	.2	.3	.2	2.4	4.2	3.3
1920	.2	.2	.2	3.8	5.6	4.7	25.3	45.9	35.6
1921	−.1	−.1	−.1	1.5	2.2	1.8	−26.7	−48.4	−37.6
1922	0	0	0	.3	.4	.4	−12.3	−21.8	−17.0
1923	−.9	−1.1	−1.0	1.3	1.9	1.6	−26.0	−46.5	−36.2
1924	2.4	2.8	2.6	−4.7	−6.8	−5.8	3.0	5.3	4.2
1925	−1.9	−2.2	−2.0	1.0	1.5	1.2	12.6	22.7	17.6
1926	.9	1.0	1.0	0	0	0	29.9	52.9	41.4
1927	.3	.3	.3	1.3	2.0	1.6	−7.9	−13.4	−10.6
1928	−.1	−.1	−.1	1.5	2.3	1.9	−11.0	−18.2	−14.6
1929	.1	.1	.1	.9	1.4	1.2	−15.2	−24.4	−19.8
1930	1.2	1.5	1.4	−3.1	−5.1	−4.1	−20.8	−33.3	−27.0
1931	2.3	2.9	2.6	.7	1.2	1.0	35.3	56.8	46.0
1932	−.5	−.6	−.6	4.2	7.4	5.8	−7.5	−11.8	−9.6
1933	−3.9	−4.9	−4.4	0	0	0	20.0	29.4	24.7
1934	−3.7	−4.6	−4.2	−7.6	−13.1	−10.4	−32.7	−46.2	−39.4
1935	−2.9	−3.6	−3.2	.1	.2	.2	−25.5	−34.4	−30.0
1936	−3.4	−4.3	−3.8	−8.5	−13.8	−11.2	−17.5	−23.2	−20.4
1937	−1.1	−1.4	−1.2	3.4	5.4	4.4	48.6	62.4	55.5
1938	−.3	−.4	−.4	1.7	2.5	2.1	8.4	10.4	9.4
1939	−.8	−.9	−.8	1.1	1.7	1.4	0	0	0
1940	−.2	−.2	−.2	−.5	−.7	−.6	2.0	2.2	2.1
1941	.8	.8	.8	.4	.5	.4	−24.7	−27.4	−26.0
1942	3.5	3.5	3.5	3.4	4.1	3.8	20.6	23.2	21.9
1943	−.3	−.3	−.3	.2	.2	.2	−.6	−.6	−.6
1944	0	0	0	−.4	−.5	−.4	35.0	37.8	36.4
1945	.1	.1	.1	−1.7	−1.9	−1.8	−15.8	−16.8	−16.3
1946	.2	.2	.2	1.7	1.9	1.8	−38.2	−40.0	−39.1
1947	2.2	2.2	2.2	−6.9	−7.5	−7.2	−1.8	−2.0	−1.9
1948	1.3	1.3	1.3	7.6	8.3	8.0	41.2	43.4	42.3
1949	−2.1	−2.1	−2.1	2.7	3.0	2.8	11.4	12.0	11.7
1950	−.9	−.9	−.9	2.3	2.5	2.4	−4.1	−4.2	−4.2

[1] Based on yields per seeded acre, expressed as deviations from 9-year moving averages, centered. The 1926–34 average was used for 1930 through 1938, so that only 2 of the 4 consecutive drought years (1933 through 1936) were included in the average or trend. The 1943–51 average was used for 1947–50. For years prior to 1919, yields per harvested acre were adjusted by the ratio of average yield per seeded acre to average yield per harvested acre during 1919–51.

[2] Based on yields per planted acre, expressed as deviations from 9-year moving averages, centered. The 1943–51 average was used for 1947–50. For years prior to 1929, yields per harvested acre were adjusted by the ratio of average yield per planted acre to average yield per harvested acre during 1929–51.

[3] Based on yields per acre in cultivation on July 1, expressed as deviations from 9-year moving averages, centered. The 1943–51 average was used for 1947–50. For years prior to 1909, yields per harvested acre were adjusted by the ratio of average yield per acre in cultivation July 1 to average yield per harvested acre during 1909–51.

[4] 1952 goal yield was 14.9 bushels per seeded acre.

[5] 1952 goal yield was 37.9 bushels per planted acre.

[6] 1952 goal yield was 280 pounds per acre in cultivation July 1.

TABLE 5.—*Wheat, corn, and cotton: Frequency distributions of yield deviations from trend, United States, 1901–50*

WHEAT

Class intervals	Actual deviations [1] (1)	Percentage deviations times 1952 goal yield [2] (2)	Average of actual deviations and percentage deviations times 1952 goal yield [3] (3)	(4)	Equivalent production deviations [4] (5)
Bushels per seeded acre:	*Number of years*	*Number of years*	*Number of years*	*Percent of years* [5]	*Million bushels*
−4.9 to −4.0	0	3	2	4	−399 to −320.
−3.9 to −3.0	3	2	3	6	−319 to −240.
−2.9 to −2.0	5	4	4	8	−239 to −160.
−1.9 to −1.0	4	4	4	8	−159 to −80.
−0.9 to 0	[6] 13	[6] 12	[6] 12	24	−79 to 0.
0 to 0.9	[6] 14	[6] 13	[6] 13	26	0 to 79.
1.0 to 1.9	5	6	6	12	80 to 159.
2.0 to 2.9	4	3	3	6	160 to 239.
3.0 to 3.9	2	3	3	6	240 to 319.
Total	50	50	50	100	

CORN

Bushels per planted acre:					*Million bushels*
−14.9 to −12.0	0	3	0	0	−1,274 to −1,020.
−11.9 to −9.0	0	0	3	6	−1,019 to −765.
−8.9 to −6.0	4	2	1	2	−764 to −510.
−5.9 to −3.0	3	5	4	8	−509 to −255.
−2.9 to 0	[7] 12.5	[7] 9.5	[7] 11.5	23	−254 to 0.
0 to 2.9	[7] 23.5	[7] 20.5	[7] 22.5	45	0 to 254.
3.0 to 5.9	6	8	7	14	255 to 509.
6.0 to 8.9	1	2	1	2	510 to 764.
Total	50	50	50	100	

COTTON

Pounds per acre in cultivation on July 1:					*1,000 bales* [8]
−59.9 to −45.0	0	5	0	0	−3,499 to −2,625.
−44.9 to −30.0	3	3	6	12	−2,624 to −1,750.
−29.9 to −15.0	12	10	11	22	−1,749 to −875.
−14.9 to 0	[9] 13.5	[9] 10.5	[9] 11.5	23	−874 to 0.
0 to 14.9	[9] 9.5	[9] 6.5	[9] 6.5	13	0 to 874.
15.0 to 29.9	7	6	7	14	875 to 1,749.
30.0 to 44.9	4	4	6	12	1,750 to 2,624.
45.0 to 59.9	1	4	2	4	2,625 to 3,499.
60.0 to 74.9	0	1	0	0	3,500 to 4,374.
Total	50	50	50	100	

[1] Based on table 4, column (1) for wheat, column (4) for corn, and column (7) for cotton.
[2] Based on table 4, column (2) for wheat, column (5) for corn, and column (8) for cotton.
[3] Based on table 4, column (3) for wheat, column (6) for corn, and column (9) for cotton.
[4] Equivalent production deviation on 80 million seeded acres of wheat, 85 million planted acres of corn and 28 million cultivated acres of cotton.
[5] Column (3) times 2.
[6] Includes 2 observations at zero.
[7] Includes 1.5 observations at zero.
[8] Bales of 500 pounds gross weight (equals 480 pounds net weight of lint).
[9] Includes one-half observation at zero.

TABLE 6.—*Wheat, corn, and cotton: Average yield deviations resulting from alternative measures of yield variability, United States, 1901–50* [1]

Commodity	Unit	Actual deviations (1)	Percent deviations times 1952 goal yield (2)	Average of actual and percentage deviations [2] (3)	Column (3) as percent of column (2) (4)
Wheat	Bushel	1.21	1.40	1.31	94
Corn	do	2.24	3.20	2.72	85
Cotton	Pound	17.20	24.90	21.10	85

[1] Deviations from trend averaged without regard to sign.
[2] If column (3) is assumed to measure the true variability of yields at the present time, column (4) expresses the degree to which the average percentage variability during 1901–50 has been modified by technological improvements, shifts in producing areas, etc.

Column (4) of table 5 expresses the likelihood of various possible deviations from the approximate trend or "expected" level of yields under 1952 or 1953 conditions. There appears to be about a 50 percent chance that the United States average wheat yield will turn out within a bushel of the trend, the corn yield within 2 bushels, and the cotton yield within 20 pounds. However, there is about a 10 percent chance that the wheat yield will be 3 bushels or more below trend, the corn yield 5 bushels or more, and the cotton yield 30 pounds or more below trend. The chances of getting very high yields are also indicated in column (4).

The adequacy of a given level of storage stocks may be judged in part by the extent to which it would offset the worst individual yields and the worst sequences of below-trend yields experienced during the 1901–50 period. These years and sequences are summarized in table 7.

Assuming 80 million planted acres, the worst individual yields for wheat would drop production 300 to 350 million bushels below the expected level. The worst sequence of yields prior to 1930 would cause a cumulative production deficit of about 450 million bushels. Allowing 100 million bushels for working stocks, these individual yields and pre-1930 sequences could have been offset almost bushel for bushel with total carry-over stocks of about 500 million bushels. However, the 1933–36 sequence could have swallowed up carry-over stocks of a billion bushels or more. Wheat feeding and exports would inevitably be reduced in the event of such a sequence. Some offset might be obtained through increased acreage, depending on weather and also upon how close acreage was to its feasible maximum at the beginning of the sequence. Judging from records extending back to 1866, a sequence as bad as 1933–36 is not likely to occur oftener than once or twice in a century.

TABLE 7.—*Wheat, corn, and cotton: Worst individual yields and sequences of yields, United States, 1901–50*

1. WHEAT

Year or sequence	Adjusted yield deviation [1] (1)	Equivalent production deviation, approximate 1951 acreages [2] (2)
	Bushels	*Million bushels*
(*a*) Individual years:		
1933	−4.4	−352
1934	−4.2	−336
1936	−3.8	−304
1935	−3.2	−256
1917	−3.2	−253
1916	−2.4	−192
1911	−2.4	−192
(*b*) Sequences:		
1932–40	−18.8	−1,504
1933–36	−15.6	−1,248
1916–17	−5.6	−448
1910–12	−4.0	−320

2. CORN

	Bushels [3]	*Million bushels*
(*a*) Individual years:		
1936	−11.2	−952
1934	−10.4	−884
1901	−10.2	−867
1947	−7.2	−612
1924	−5.8	−493
1930	−4.1	−348
1913	−4.0	−340
(*b*) Sequences:		
1934–36	−21.4	−1,819
1916–18	−6.4	−544
1907–09	−3.6	−306

3. COTTON

	Pounds [4]	*Million bales* [5]
(*a*) Individual years:		
1909	−42.8	−2.50
1934	−39.4	−2.30
1946	−39.1	−2.23
1921	−37.6	−2.19
1923	−35.2	−2.11
1935	−30.0	−1.75
1901	−29.2	−1.70
(*b*) Sequences:		
1921–23	−90.8	−5.30
1934–36	−89.8	−5.24
1927–30	−72.0	−4.20
1909–10	−64.8	−3.78
1901–03	−57.4	−3.35
1945–47	−57.3	−3.34
1915–18	−43.9	−2.56

[1] Data from table 4, column (3).
[2] Wheat 80 million and corn 85 million planted acres; cotton, 28 million acres in cultivation July 1.
[3] Data from table 4, column (6).
[4] Data from table 4, column (9).
[5] 500 pounds gross weight (equals 480 pounds net weight of lint).

Assuming 85 million planted acres for corn, the worst individual yields would cause production to fall 850 to 950 million bushels below the trend level. Other than 1934–36, the worst sequences were not as severe as some of the individual years. Allowing something for the flexibility of the livestock-and-feed economy, these other sequences and all but the three worst individual yields could have been adequately offset by initial stocks of 600 to 800 million bushels of corn. This would allow for working stocks of 150 million bushels, and also for the fact that production of other feed grains tends to vary in the same direction as that of corn. However, the 1934–36 sequence would have caused serious hardship to livestock producers in the third year, even given an initial carry-in approaching the billion-bushel level. There has been no other sequence of equal severity in the 86 years for which data are available.

Assuming 28 million acres for cotton the worst individual yield deviations would cause production to fall from 2 to 2.5 million bales below the trend or expected level. The two worst sequences would, on such an acreage, produce a cumulative 3-year production deficit of over 5 million bales. Two other sequences, one of 4 and the other of 2 years' duration, would mean cumulative deficits of about 4 million bales. Assuming working stocks of 2 million bales, a total carry-over of 6 million bales could have offset all but the two worst sequences in full, or nearly so. In those sequences a deficit of over 1 million bales would have appeared, mostly in the third year.

The relationship of the normal level of acreage in major crops to the maximum feasible level has some relevance to the amount of stocks needed to offset sequences of low yields. If we could always count on expanding acreage of wheat, corn, or cotton by 10 percent in a single year, starting from the level needed to meet requirements at trend yields, we could increase expected production by 10 percent in the year following a low yield. An acreage reserve of that size would be equivalent to 100 million bushels of wheat, 300 million bushels of corn, and 1½ million bales of cotton per year.

Variations in acreage.—Figure 3 shows estimated acreages of wheat corn, and cotton in the United States from 1901 to date. Percentage-wise, year-to-year changes in corn acreage have been smaller than in acreages of wheat and cotton. The sharpest year-to-year reductions in wheat and cotton acreages during the past two decades have been due to Government programs, although substantial fluctuations occurred even in the 1920's.

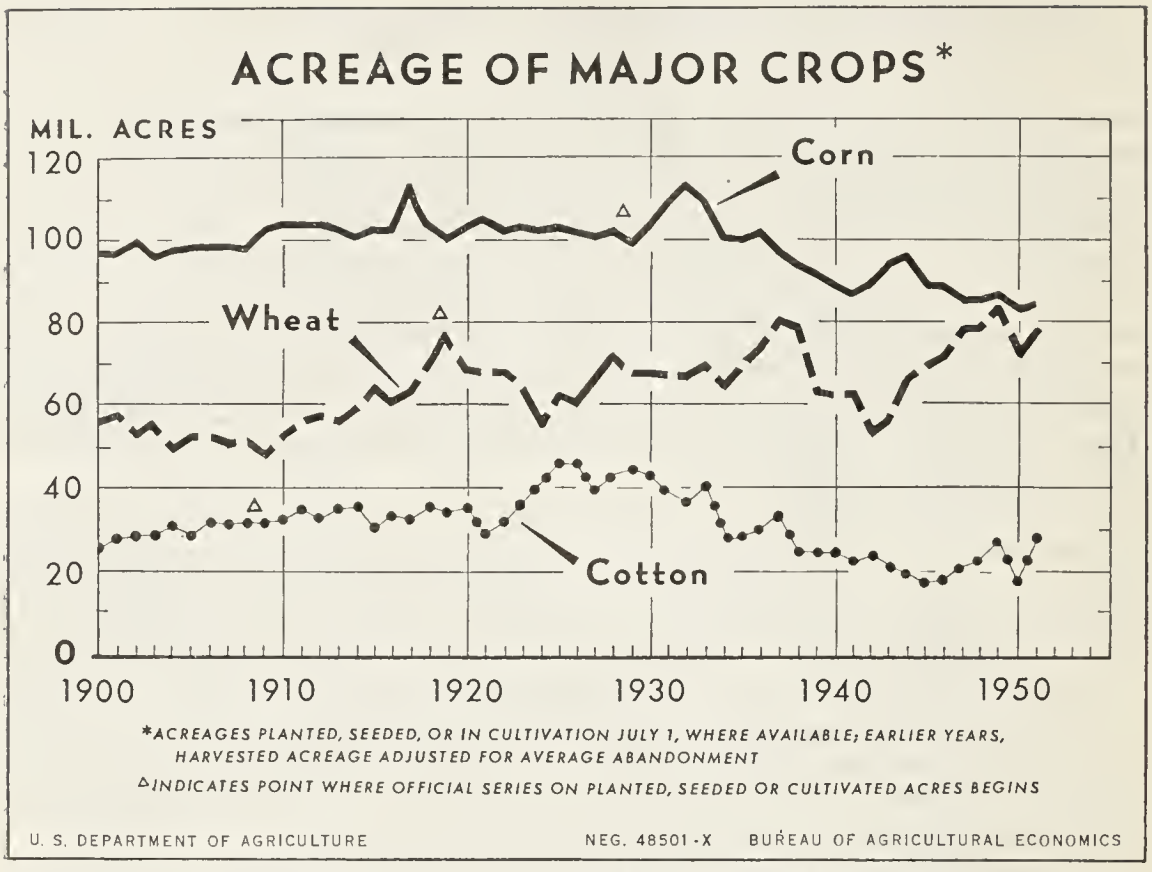

FIGURE 3.—During the past 20 years corn acreage has trended downward at an average rate of 1 million acres a year, falling from well over 100 million acres in 1932 to less than 85 million in 1951. Wheat acreage has ranged from 53 million to as high as 84 million within the past 10 years, the lowest figures being due to acreage allotments. Cotton acreage has trended downward since the 1920's. During the past 10 years acreage in cultivation on July 1 has been as low as 18 million and as high as 28 million.

Figures 4, 5, and 6 portray the relative influence of acreage and yield upon year-to-year changes in production of the three crops. The "direct effect of yield" is defined as the change in yield from one year to the next multiplied by the acreage of the earlier year. The "direct effect of acreage" is the change in acreage from one year to the next multiplied by the yield of the earlier year. The sum of these direct effects is not exactly equal to the change in production, but differs from it by the product of the two changes. In most years this "interaction term" is quite small relative to the direct effects.

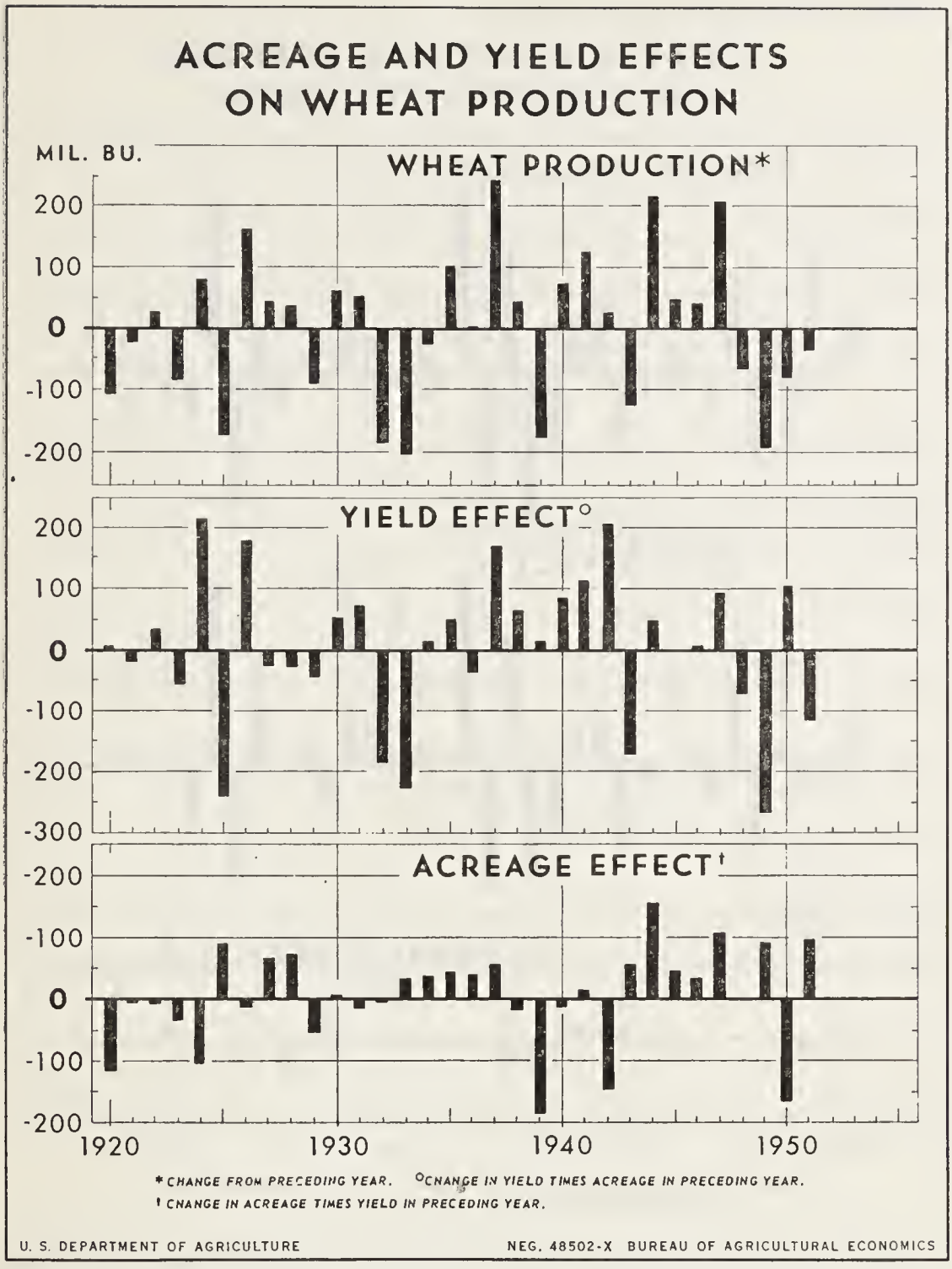

FIGURE 4.—Prior to 1939 variations in wheat production were primarily due to changes in yields. But since 1938 wheat acreage has been sharply reduced on three occasions by application of acreage allotments. Yield variations since 1939 have been almost as great as those in earlier years but the effects of acreage change have been considerably greater than during the years 1919 through 1938.

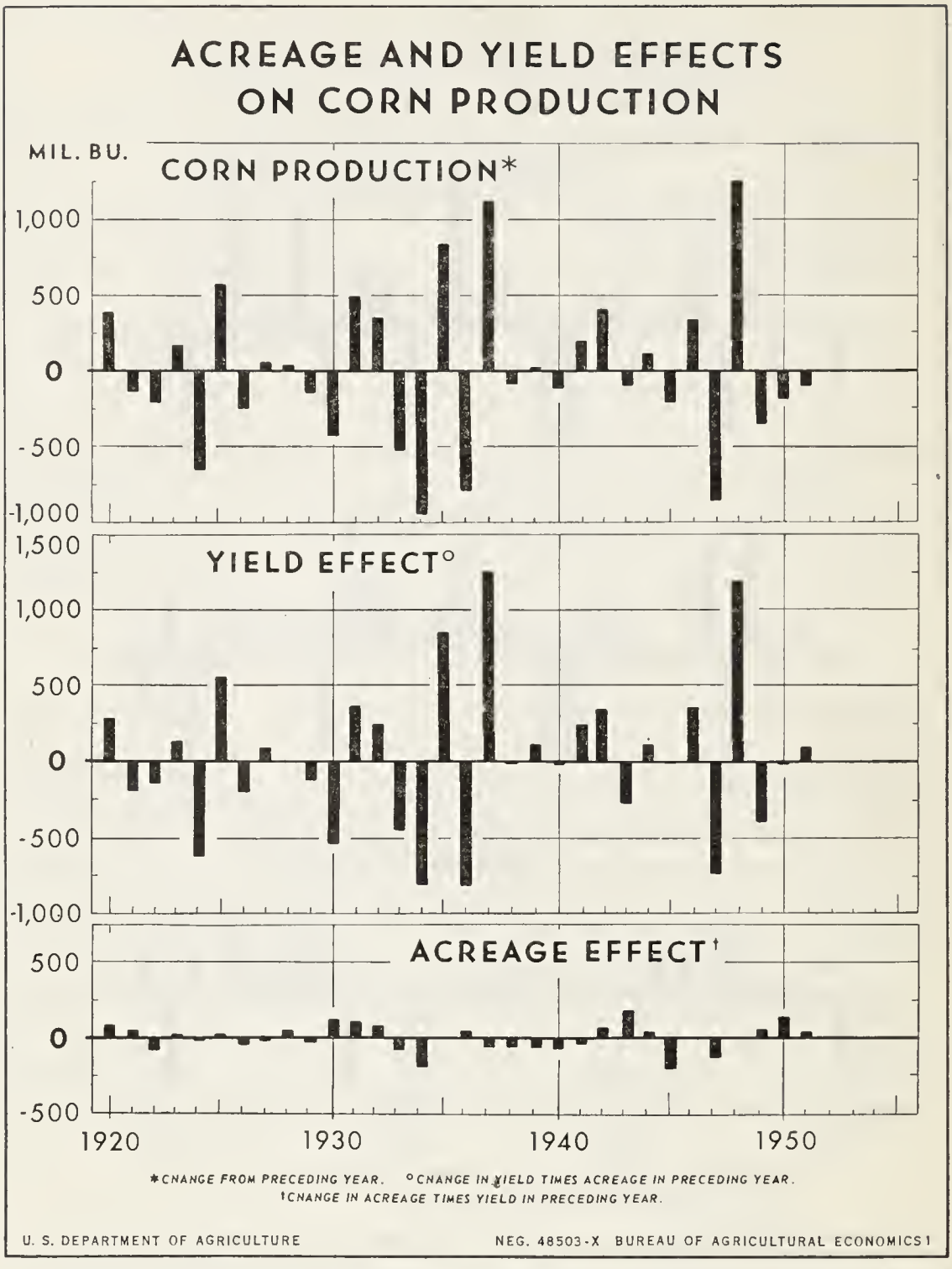

FIGURE 5.—Corn acreage changes very little from one year to the next—seldom more than 3 million acres or 3 or 4 percent. Acreage allotments have been used only rarely and have not caused sharp reductions in corn acreage. Almost all of the variations in corn production have been due to variations in yields which are not subject to human control on a year-to-year basis.

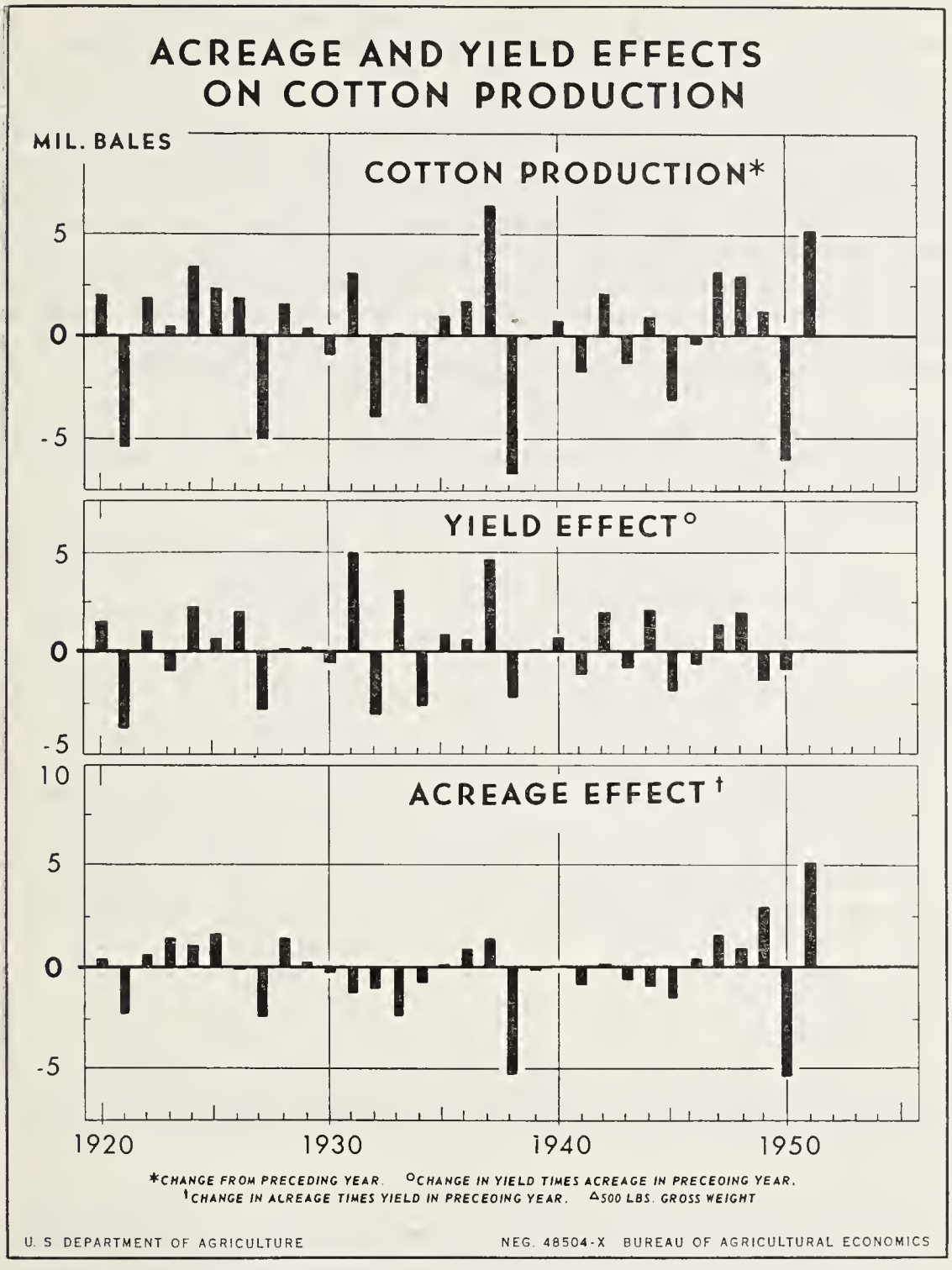

FIGURE 6.—Yield variations had a greater effect on cotton production than changes in acreage before 1933. However, beginning with 1933 Government programs (acreage allotments and marketing quotas) have been used extensively and have brought several sharp reductions in cotton acreage with acreage increasing rather sharply in years when controls were removed. There is some indication that cotton yields have been less variable during the past 10 to 15 years than they were during the 1920's and 1930's.

Prior to 1938, changes in wheat acreage had much less effect on production than did changes in yield. Since 1938 the influence of acreage change has almost equaled that of yield. The increased variation in acreage has been due mainly to acreage-allotment programs which were responsible for the sharp acreage reductions in 1939, 1942, and 1950. Corn acreage has been less affected by programs, and its influence on year-to-year changes in production has been very small relative to that of yield. Changes in cotton acreage have been about as important as changes in yield in determining recent year-to-year changes in production. Marketing quotas were responsible for the sharp acreage reductions in 1938 and 1950. The information in figures 4, 5, and 6 is summarized by averaging the year-to-year changes in each series without regard to sign. (See table 8.)

TABLE 8.—*Wheat, corn, and cotton: Average year-to-year changes in production, and relative importance of direct acreage and yield effects upon production, United States, 1919–51*

Commodity and period	Average year-to-year change in production [1]	Relative effects on production of—	
		Changes in acreage	Changes in yield
	(1)	(2)	(3)
	Million bushels	*Percent* [2]	*Percent* [2]
Wheat:			
(*a*) 1919 to 1938	93	32	68
(*b*) 1938 to 1951	110	48	52
(*c*) 1919 to 1951	100	40	60
Corn:			
(*a*) 1919 to 1938	437	14	86
(*b*) 1938 to 1951	334	21	79
(*c*) 1919 to 1951	395	16	84
	Thousand bales		
Cotton:			
(*a*) 1919 to 1932	2,501	38	62
(*b*) 1932 to 1951	2,588	52	48
(*c*) 1919 to 1951	2,552	46	54

[1] Upward and downward changes in production averaged without regard to direction of change.
[2] Measured by totaling the direct effects of acreage and of yield changes without regard to direction of change, and allocating these "total direct effects" in proportion to the absolute values of acreage and yield effects taken separately.

It should be noted that the variability of corn, wheat, and cotton acreages discussed above applies only under conditions and within the acreage ranges actually prevailing at the time. Meanwhile, acreages of wheat and cotton were relatively high in 1951 and this is equally true for corn when account is taken of increased competition of soybeans for midwestern acreage. Substantial increases in acreages of these crops above 1951 will be difficult to obtain. This underscores the importance of increasing average per acre yields both in order to meet requirements of an increasing population and also to allow farmers to meet normal requirements without having to continuously plant maximum acreages. With such a development, acreage expansion would offer some possibility for replenishing stocks after a sequence of low yields or for meeting emergency requirements. This would also permit increased attention to conservation and grassland farming.

SUPPLEMENT 2.—RELATIONSHIPS BETWEEN FEED SUPPLIES AND LIVESTOCK PRODUCTION

Reserves of corn and other feed grains are desired not for their own sake but chiefly for their contribution to livestock production. Feed reserves help to reduce the variability of livestock production and would be of special value in substantially easing the drastic livestock liquidations which have been associated with severe drought. In the event of war, feed reserves give us assurance that our intensified needs for livestock products will not be unduly thwarted by a year or two of unfavorable weather.

This section will be concerned chiefly with the basic interrelationships between feed supplies and livestock production, and with a discussion of historical variations in livestock output.

Relative dependence of different classes of livestock upon feed grains and other feeds.—Corn is by far our most important harvested feed crop. However, discussions of corn storage can overstate the importance of corn in the total livestock-feed picture. In 1950–51 only 26 percent of the total feed consumed by livestock was derived from corn. Other grains made up 10 percent of the total and byproduct feeds, such as oilseed meals, made up another 10 percent. Fifty-four percent of the total feed intake last year came from roughage—22 percent from hay, silage, and stover and 32 percent from pasture and range. Thus, a 10-percent change in the quantity of corn available for livestock feeding would have meant a change of only 2.6 percent in the total feed supply, assuming that supplies of other feeds remained constant. If the total supply of corn and other grains available for feeding had changed 10 percent the supply of all feed nutrients would have changed only 3.6 percent.

But the picture is much different for individual classes of livestock. Figure 7 shows the distribution of total feeds fed in 1950–51 according to major classes of livestock and the major types of feed fed to each. Tables 9 and 10 present the basic data in somewhat greater detail. Hogs derived 72 percent of their total nutrients from corn and an additional 13 percent from other grains. Thirteen percent more came from byproduct feeds and only 2 percent from pasture. Corn provided nearly two-thirds of total nutrients for cattle on feed and over 40 percent of total nutrients for poultry. Poultry obtained an additional 28 percent of their nutrients from other grains. Thus, hog raising and cattle feeding are extremely vulnerable to changes in supplies of corn. Poultry and egg production derives some protection from its dependence on the more stable supplies of byproduct feeds and upon wheat and other small grains in addition to corn.

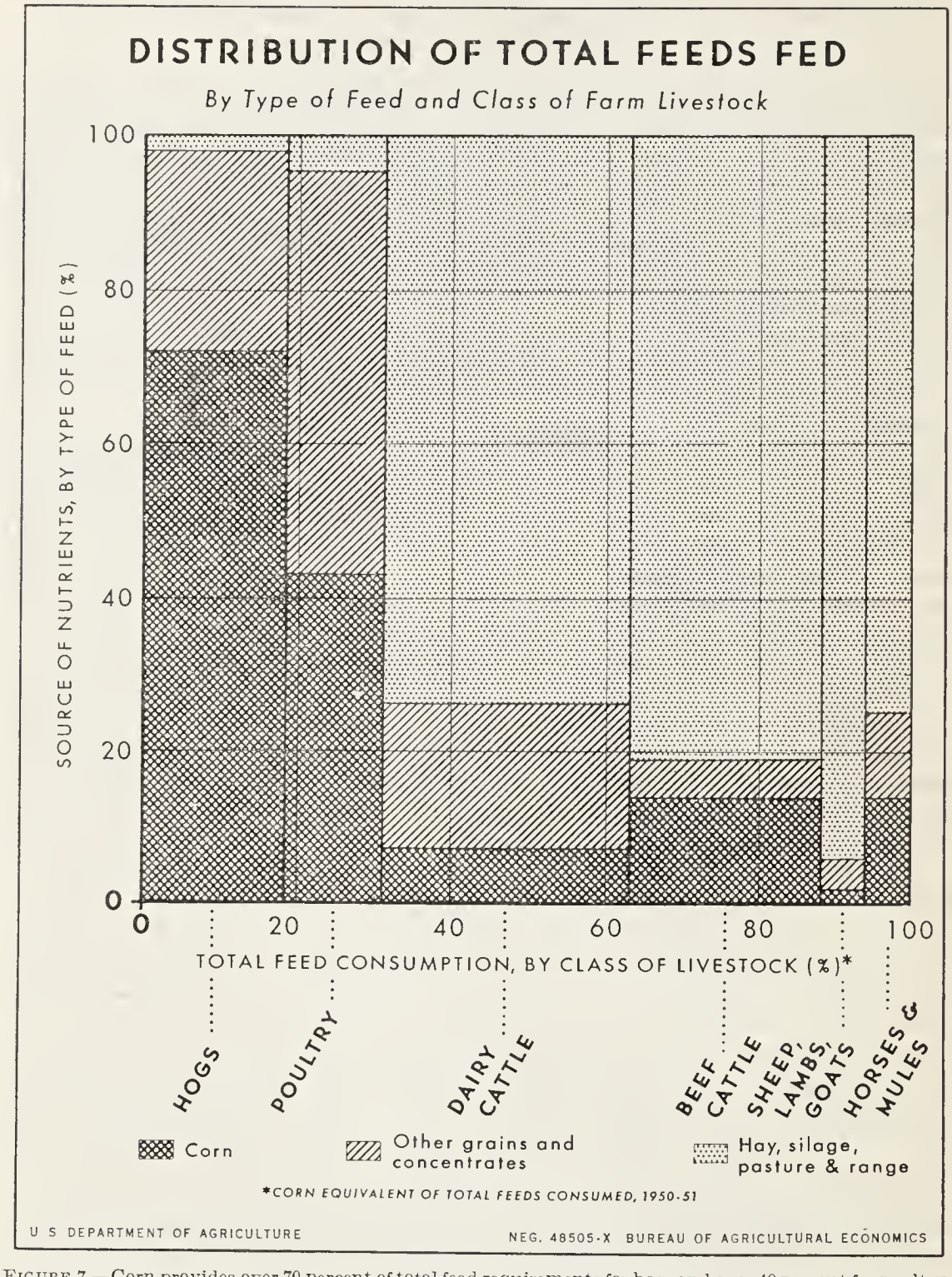

FIGURE 7.—Corn provides over 70 percent of total feed requirements for hogs and over 40 pereent for poultry. Other feed grains and byproduct feeds provide most of the remaining nutrients for hogs and poultry. Dairy and beef cattle and sheep and lambs consume about 60 percent of total feed nutrients, but 75 percent or more of their feed requirements come from hay, range, and pasture. A change in corn supplies has its greatest impact on hogs but changes in corn supplies and prices also have significant effects upon the whole livestock-feed situation.

TABLE 9.—*Sources of feed (in terms of feed units) for each class of livestock, United States, 1950–51* [1]

[Percent]

Class of livestock	All feed	Corn	Other grains	Byproduct feeds	Hay, silage, and stover	Pasture
All livestock	100	26	10	10	22	32
Dairy cattle	100	7	8	11	39	35
(*a*) Milk cows	100	7	8	12	38	35
(*b*) Other	100	9	8	8	43	32
Beef cattle	100	14	2	3	23	58
(*a*) On feed	100	64	3	9	24	----
(*b*) Other	100	5	2	2	23	68
Hogs	100	72	13	13	----	2
Sheep and lambs	100	2	2	2	19	75
Poultry	100	43	28	24	----	5
(*a*) Hens and pullets	100	40	32	23	----	5
(*b*) Chickens raised, (*c*) Commercial broilers, (*d*) Turkeys	100	46	24	25	----	5
Horses and mules	100	14	11	(2)	41	34
Other livestock	100	46	17	25	12	----

[1] Based on data in table 10.
[2] Less than 0.5 percent.

TABLE 10.—*Total feed consumed by each class of livestock (in terms of feed units), United States, 1950–51* [1]

[Million tons, corn eqnivalent]

Class of livestock	All feed	Corn	Other grains	Byproduct feeds	Hay, silage, and stover	Pasture and range
All livestock	282.2	73.0	28.2	29.2	60.6	91.2
Dairy cattle	89.1	6.6	6.8	10.2	34.5	31.0
(*a*) Milk cows	72.0	5.1	5.4	8.8	27.2	25.5
(*b*) Other	17.1	1.5	1.4	1.4	7.3	5.5
Beef cattle	69.4	9.5	1.7	2.3	15.8	40.1
(*a*) On feed	10.2	6.6	.3	.9	2.4	----
(*b*) Other	59.2	2.9	1.4	1.4	13.4	40.1
Hogs	51.8	37.2	7.0	6.7	----	.9
Sheep and lambs	16.1	.4	.4	.3	3.0	12.0
Poultry	34.6	14.9	9.8	8.2	----	1.7
(*a*) Hens and pullets	18.1	7.3	5.8	4.1	----	.9
(*b*) Chickens raised, (*c*) Commercial broilers, (*d*) Turkeys	16.5	7.6	4.0	4.1	----	.8
Horses and mules	16.4	2.2	1.7	.3	6.7	5.5
Other livestock	4.8	2.2	.8	1.2	.6	----

[1] Feed consumed by livestock expressed in equivalent tonnage of corn. Based on information in Consumption of Feed by Livestock, Circular 836, December 1949, Bureau of Agricultural Economics, extended to 1950–51 feeding season.

Dairy cattle in 1950–51 consumed almost a third of the total feed supply. But they obtained only about 7 percent of their nutrients from corn. Eight percent more came from other grains and 11 percent from byproduct feeds. Seventy-four percent of their nutrients were in the form of hay, silage, and pasture. If the supply of corn available specifically to dairy cattle were reduced 10 percent, the total supply of feed for dairy cattle would be reduced by less than 1 percent. If the supply of all grains available to dairy cattle were reduced 10 percent the total nutrients would be reduced about 1½ percent. We see in these facts an important reason for the stability of milk production in spite of short corn crops such as those of 1934 and 1936. But at the same time the fact that dairy cattle obtain the great bulk of their pasture nutrients during the months April–October significantly increases the importance of corn prices and the grain situation on the profitability of dairying from November into the following April.

Beef cattle in 1950–51 consumed a fourth of all feeds fed to livestock. Cattle on feed accounted for only 15 percent of total nutrients consumed by beef cattle, but they got nearly 70 percent of the corn fed to beef cattle. Other beef cattle obtained fully 90 percent of their feed from range, pasture and hay and only 5 percent specifically from corn.

Sheep and lambs used only 5 percent of the total feed supply in 1950–51, and obtained only 2 percent of their feed from corn. Almost 95 percent of the total feed ingested by sheep came from roughage—75 percent of it from range and pasture. Horses and mules also consumed about 5 percent of the total feed supply of which 14 percent came from corn and 12 percent from other grains.

Over the years there has been considerable association between changes in corn production and changes in production of other feed grains, but this relationship has been by no means uniform. Aggregate supplies of byproduct feeds, such as wheat millfeeds, oilseed meals, hominy and corn-gluten feeds, are relatively stable from year to year. Production of hay for the Nation as a whole shows very little association with production of feed grains on a year-to-year basis, although a severe drought in a particular area may reduce both hay and feed-grain production at the same time. Except in extreme years, there seems to be little association on a national basis between year-to-year changes in the production of feed grains and in the quantity of feed obtained from range and pasture during the corresponding October–September feeding years. But this is not necessarily always true for particular areas, while during the extreme drought years, of course, large areas in the Great Plains suffered a disastrous reduction in range feed as well as in supplies of hay and grain.

When we look at corn and other feed grains in the framework of total feed supplies, we can understand how livestock production in the aggregate was fairly well maintained even during the 1934–36 drought period. The reduction of roughly 40 percent in corn production between 1933 and 1934 meant in itself only a 10-percent reduction in the total supply of feed. The fact that other feed grains, hay, and even grass in certain areas were also affected gave the 1934 drought its particularly severe character. Further, a 10 percent reduction in total feed fed to livestock would ordinarily mean something less than

a 10-percent reduction in the output of livestock products, as some efficiencies are possible when feed supplies are very short. Again, however, we should not overlook the fact that short feed supplies can and do significantly affect the profitability of livestock operations even though immediate production may be fairly well maintained.

Regional differences in livestock and feed production and in feed requirements.—The geographical distribution of livestock and feed production is a subject of considerable interest in its own right. However, the present discussion will be limited to those aspects of regional distribution which are rather immediately relevant to grain storage.

A central problem is the extent to which feed grains must move off of the farms where they are produced in order to maintain the existing pattern of livestock production in the same or other areas. Regional specialization and enterprise specialization in livestock production are both predicated upon a large and relatively stable movement of feed grains through commercial channels and across regional lines. The extent of this commercial movement has distinct implications for the quantity of grain reserves which might be stored in off-farm positions, since the original producer has first call on farm-stored grain.

To a considerable extent, the livestock production pattern of each region has adapted itself to the capacity of the region for producing grain and roughage respectively. However, the presence of human population has also exerted a strong locational pull.

Range and pasture resources must be utilized on the spot. And because of its bulk, hay production must also take place fairly close to the livestock which are to consume it. The feed concentrates, both grains and byproduct feeds, are sufficiently valuable relative to transportation costs that they may be shipped long distances for feeding purposes. The cost of importing the entire feed supply of a given class of livestock from considerable distances is still prohibitive in most cases. But a region which is well supplied with hay and pasture for its dairy cattle may import 10 to 20 percent of its total nutrients from other regions in the form of grains and byproduct feeds, and specialized broiler-producing areas may ship in much higher proportions than this.

Table 11 summarizes the percentage distribution of livestock and feed production among the six major geographic regions of the United States. The last column represents the percentage of production of a given commodity which would have to be transported across regional lines if its consumption were distributed in proportion to some other commodity or factor. For example, the first section of the table indicates that, if consumption per person were the same in all regions, about 20 percent of all milk, eggs, and farm chickens produced would be shipped to other regions. On the other hand, 45 to 50 percent of hog, sheep, and lamb production would be consumed in other than the producing region.

TABLE 11.—*Percentage distribution of livestock production by major regions compared with human population, feed-grain production, and hay production, United States, 1950*

Item	United States (1)	North Atlantic (2)	East North Central (3)	West North Central (4)	South Atlantic (5)	South Central (6)	West (7)	Implied inter-regional move-ment [1] (8)
	1. Livestock production [2] and human population							
Population	100.0	26.2	20.2	9.3	14.0	17.3	13.0	
Grain-consuming livestock	100.0	8.0	25.0	36.0	8.8	14.3	7.9	31.5
Milk	100.0	16.8	29.6	22.2	7.2	12.9	11.3	22.3
Eggs	100.0	17.9	20.2	29.3	7.8	14.1	10.7	20.0
Chickens, farm	100.0	16.2	21.1	27.6	9.1	17.2	8.8	19.2
Broilers	100.0	15.7	9.4	4.5	46.3	18.2	5.9	33.2
Turkeys	100.0	7.5	12.4	26.7	9.7	12.5	31.2	35.6
Hogs	100.0	1.6	29.8	46.9	7.0	12.0	2.7	47.2
Cattle and calves	100.0	4.8	15.5	34.3	5.0	22.5	17.9	35.1
Sheep and lambs	100.0	1.2	10.0	22.7	2.9	19.8	43.4	46.3
	2. Livestock production and feed-grain production							
Production of 4 feed grains 1946–50	100.0	3.3	30.4	43.1	6.5	12.5	4.2	
Grain-consuming livestock	100.0	8.0	25.0	36.0	8.8	14.3	7.9	[3] 12.5
Hogs	100.0	1.6	29.8	46.9	7.0	12.0	2.7	4.3
Eggs	100.0	17.9	20.2	29.3	7.8	14.1	10.7	24.0
All poultry	100.0	14.7	15.5	19.2	22.5	16.8	11.3	38.8
Milk	100.0	16.8	29.6	22.2	7.2	12.9	11.3	21.7
Cattle and calves	100.0	4.8	15.5	34.3	5.0	22.5	17.9	25.2
Broilers	100.0	15.7	9.4	4.5	46.3	18.2	5.9	59.6
	3. Livestock production and hay production							
Hay production 1946–50	100.0	13.7	19.6	28.6	5.8	11.6	20.7	
Milk	100.0	16.8	29.6	22.2	7.2	12.9	11.3	15.8
Cattle and calves	100.0	4.8	15.5	34.3	5.0	22.5	17.9	16.6
Average, milk and cattle	100.0	10.8	22.6	28.2	6.1	17.7	14.6	9.4

[1] Percentage of total United States production which would have to move across regional lines to adjust consumption of 1 commodity to the regional distribution of another commodity or of human population. Actual net interregional movement may differ from this due to regional differences in food-consumption patterns and in livestock-feeding practices.

[2] Production of meat animals and poultry is liveweight production on farms.

[3] Livestock production is assigned to the region in which feed is consumed and weight gained. Hence, this coefficient implies a movement of feed grains to livestock, rather than of livestock to feed grains.

It is clear from table 11 that the North Atlantic region is deficient in all types of livestock production shown, while the West North Central region is a surplus producer of all listed livestock products except broilers. The South Atlantic region is a deficit area except for broilers, while the other three regions appear to be surplus with respect to some livestock products and deficit with respect to others. The over-all status of each region is roughly indicated by the distribution of "all grain-consuming livestock," an index in which each class is weighted by its share of total feed-grain consumption in 1950–51. If per capita consumption were equal in all regions, over 30 percent of all livestock production based upon grain would have to move across regional lines. On a net basis, six-sevenths of the movement would originate in the West North Central region and one-seventh in the East North Central region. About three-fifths of the total movement would terminate in the North Atlantic region and the remainder would be divided about equally between the South Atlantic, South Central, and Western regions.

Without exception, the regions which are deficient in production of grain-consuming livestock are also deficient in production of feed grains relative to their feed requirements. To equalize feed-grain consumption with apparent requirements, about one-eighth of total feed-grain production would have to be transported across regional boundaries. In terms of total feed-grain consumption in 1950–51, this would amount to about 12½ million tons, or the equivalent of about 450 million bushels of corn. On a net basis, the entire movement would originate in the two North Central regions, and the largest single share would go to the North Atlantic region.

Table 11 leads to a minimum estimate of the commercial movement of feed grains for feed uses. Additional quantities move between States and counties within each region, and even between farms in a given county. The total commercial flow of feed grains also includes sizable quantities for the milling and beverage industries and for export. Past experience indicates that changes in feed-grain production result in much sharper percentage changes in the quantity of feed grains sold for all uses. Since food and beverage industries are generally in a strong bidding position, the bulk of the adjustment falls on sales for feed and export.

Livestock production in the grain-deficit areas is strongly rooted in the economic and institutional fabrics of those areas, in their pasture and hay resources, and in the fixed investments of a great many farmers. Hence, one function of a grain-storage program is to help stabilize supplies actually available to livestock producers in the feed-deficit regions. To perform this function, substantial quantities of feed grains must be carried in locations and ownerships which make them readily available for movement across State and regional boundaries.

Differences in effects of feed grain supplies upon various farming types.—The relative dependence of different classes of livestock upon the various types of feed has already been discussed on a national basis. However, the conditions under which given livestock products are produced may vary significantly between areas. In the West North Central region many farm chickens are fed almost wholly on feed produced on the same farm. This is in sharp contrast to commercial broiler and egg-producing enterprises, such as those on the Atlantic seaboard, for which virtually all of the required feed may be purchased from dealers. Similarly, conditions of milk production range from "dry lot" dairies in certain metropolitan areas, which purchase all of their feed, to balanced dairy farms in the Corn Belt and Great Lakes States which may go for years at a time without buying either grain or roughage. Naturally enough, the livestock enterprises which are most dependent upon purchased grain are concentrated in regions which are deficient in over-all production of feed grains, so that the problems of enterprise specialization and regional specialization overlap to a considerable extent.

Farmers in feed-deficit and in feed-surplus areas are perhaps equally interested in obtaining adequate quantities of feed. However, the impact of changes in feed prices may be somewhat different. An increase in the price of purchased feed has an immediately discernible effect upon the profit margin of a broiler or "dry lot" dairy enterprise until or unless prices of broilers and milk can be adjusted upward. Many dairy farmers in the Corn Belt have a less immediate interest

in the market price of grain since they market their feed crops mainly in the form of milk and butterfat.

Responses of livestock production to changes in feed supplies.—The preceding pages have outlined the cross-section structure of the feed-grain and livestock economy at a particular point in time. One of the major objectives of grain storage is to reduce variations in livestock production from year to year and, in particular, to avert undue liquidation of livestock in years of short grain crops. To some extent, the responses of livestock production to feed supplies over time are indicated by the relative dependence of various classes of livestock upon various types of feed. But some additional factors are also involved.

Livestock-production responses take the form of changes in numbers raised and also of changes in rates of feeding and output per animal. The most rapid increase in numbers can be made in the case of commercial broilers. Not more than 15 or 16 weeks is necessary for a significant production response. Under general farming conditions, young chicks can be raised for market as broilers or fryers on perhaps 4 months' notice. But in most general farming areas, hatchery operations are highly seasonal and major decisions as to changes in the size of laying flocks or in numbers of chickens raised tend to be concentrated in late winter and early spring. Production of turkeys has also been strongly seasonal, and hatching eggs have been set mainly in late winter and early spring.

Hog numbers respond quite rapidly to changes in grain supplies, though the timing of spring and fall farrowing is strongly seasonal. The level of corn supplies and prices during the September–December period influences hog producers' decisions as to the number of sows bred for spring farrowing. Spring pigs are ready for market during the following September–March period, so that there is a lag of about 12 to 15 months between the harvest of a large corn crop and the marketing of an increased spring pig crop. Decisions as to the number of sows bred for fall farrowing will typically be made during the March–June period. Corn supplies and prices during this time are chiefly determined by the size of the feed grain crop harvested in the preceding fall, although there may be some preliminary indications by June as to how the current year's crop is developing. The fall pigs are mostly marketed during the following April–August period. Hence, an increased corn harvest in the autumn of one year tends to be reflected in an increased slaughter of hogs beginning in the following autumn and extending for almost 12 months thereafter.

The response of cattle numbers to changes of any kind is necessarily slow. The gestation period for cattle is about 9 months, and beef cattle are generally sold for slaughter at the age of 18 to 30 months. Thus, there is close to a 3-year lag between a change in breeding operations and a resulting change in cattle slaughter. Changes in cattle numbers have traced out "cycles" of 10 to 15 years' duration, and have been relatively independent of short-term changes in feed-grain supplies. A dairy cow is ready for milk production at the age of 2 to 3 years. While short-run increases in the number of dairy cows can be made by culling the older cows less closely, or by culling fewer of the heifers and heifer calves held as replacements, in actual practice such increases are relatively small.

Sheep and lambs obtain 75 percent of their total feed from range and pasture, and close to 20 percent from other types of roughage. Changes in numbers of sheep and lambs on farms show no association with year-to-year changes in feed-grain supplies.

The swiftest adjustment that can be made to increased supplies of feed grains is to increase the rates of feeding of livestock already on hand. For most classes of livestock, this adjustment speedily runs into diminishing returns. A high rate of concentrate feeding of dairy cows may even lead to their failing to take advantage of the full amount of pasture and hay which is available.

In years of large corn supplies, hogs are generally fed more liberally and are marketed at heavier weights. The average weights of hogs slaughtered under Federal inspection have varied from less than 225 pounds in 1 or 2 years of drought to 250 pounds or more at some times when feed supplies were ample and hog-corn price ratios favorable.

The number of cattle put on intensive feed tends to increase in years of large corn supplies and low corn prices. The profitableness of feeding cattle depends upon the margin between prices paid for feeder cattle and prices received for slaughter cattle relative to the prices of corn and other feeds. When the price of corn is low relative to this margin, cattle are fed longer periods and marketed at higher average weights.

Farm chickens also tend to be fed more liberally when feed-grain supplies are large and prices low. This in turn tends to increase the rate of lay per hen and also the average weight at which hens and young chickens are marketed. Similar effects may occur in the case of turkeys, at least in some areas. This effect is less significant in the production of commercial broilers.

Changes in livestock numbers tend to increase output of livestock products in the same proportion, if the rate of feeding per head is unchanged. Changes in rates of grain feeding per head can be made more rapidly, but result typically in much less than proportionate changes in livestock production. Changes in actual production of livestock from one grain-feeding year to the next combine both types of effects.

During the 1926–50 period, a year-to-year change of 10 percent in total feed concentrates fed was associated with an average change of 3.4 percent in total livestock production (table 12). If we allow for the fact that concentrates provide only 40 to 50 percent of the total feed supply this relationship appears reasonable. The fact that the ratio of an increase in livestock production to an increase in consumption of concentrates is only 0.34 rather than 0.40 to 0.50 suggests the existence of diminishing returns with respect to consumption of all feeds. It should be clearly noted that the response of livestock production to changes in the feeding of concentrates alone is not a proper measure of the efficiency of total feed utilization.

TABLE 12.—*Average changes in livestock production associated with changes in total feed concentrates fed, United States, 1926–50* [1]

Item	Average change associated with 1 percent change in total concentrates fed		Coefficient of determination [2] (r^2)
	Percent change	Standard error	
Livestock production units (total)[3]	0.34	0.06	0.62
Hogs [4]	.67	.14	.50
Cattle [4]	.24	.06	.38
Turkeys	.44	.21	.18
Milk	.07	.03	.16
Eggs	[5].11	.08	[5].08
Chickens	[5].18	.15	[5].06
Broilers	[5].03	.26	.00
Sheep [4]	[5].03	.11	.00

[1] Livestock production, calendar years unless otherwise noted; feed consumption, years beginning preceding Oct. 1.
[2] Proportion of total variation in livestock production which was associated with changes in total feed concentrates fed. Perfect association means a coefficient of 1.00. Variation not statistically associated with feed concentrate consumption is presumably due to other factors.
[3] Years beginning Oct. 1.
[4] Liveweight production.
[5] Not significantly different from zero.

Relationships between total feed concentrates fed to all livestock and production of individual classes of livestock or products are summarized in table 12, on the basis of year-to-year changes. The livestock production changes are for calendar years; the feed-consumption series refers to the preceding October–September feeding seasons, which allows for an average lag of 3 months between feed consumption and livestock production. (It should be noted that production in the case of meat animals means liveweight production on farms rather than meat production or liveweight of animals slaughtered.) The associations are fairly close in the case of hogs and cattle, but are relatively small in the cases of other livestock and livestock products. On the average, a 10-percent change from year to year in total feed concentrates fed was associated with a change of 6.7 percent in liveweight production of hogs, 2.4 percent in liveweight production of cattle, 4.4 percent in production of turkeys, and 0.7 percent in production of milk. The relationships for turkeys and milk are barely significant from a statistical standpoint, while the percentage change coefficients for eggs, chickens, broilers, and sheep were not significantly different from zero.

However, there are some reservations which must be kept in mind. Table 12 simply shows average relationships between the corresponding year-to-year changes in concentrates fed and livestock production. These relationships do not measure either the profitableness of livestock operations or the cumulative effect of short or abundant feed supplies. For example, the feed situation is closely watched by, and materially affects, dairy and poultry producers generally, especially those in the East and on the Pacific coast.

Further implications of livestock and feed interrelationships.—It is clear from the foregoing considerations that a storage program which stabilized the supply of corn would have its greatest effect upon the stability of hog production. Under peacetime conditions and in the absence of price controls, the effect of fluctuations in feed-grain supplies upon milk, beef, lamb, and poultry production would be smaller.

Some problems, of course, are minimized when we consider the variability of feed production only on a national level. Feed grains and byproduct feeds can be shipped rather long distances, and they have a Nation-wide market with a well-integrated price structure. Ordinarily, hay moves over short distances. Thus, emergencies resulting from short hay supplies in a given area must generally be adjusted on the basis of supplies within the same general region. In extreme local droughts, range and pasture resources may be insufficient to carry the livestock through, even when hay and feed concentrates are available from other areas.

Because of the localized, or at least regionalized, nature of roughage production and consumption, national feed policy has been mainly concerned with corn and other feed grains. Storage programs for these grains have increased the stability of feed-grain consumption in recent years. During 1926–37 approximately 30 percent of a year-to-year change in corn production was taken up by changes in the rate of accumulation of carry-over stocks of corn. About 60 percent of a change in corn production was absorbed, on the average, by changes in livestock feeding. During 1938–50, on the other hand, 60 percent of a year-to-year change in corn production has been taken up by changes in the rate of stock accumulation and only 30 percent by changes in livestock feeding. The differences between these measures for the preprogram and program periods are statistically significant according to usual criteria. They suggest that the price support and storage programs in force during the past 12 to 15 years may have reduced the earlier variability of corn consumption by livestock as much as 50 percent.

Similar results are obtained if we relate year-to-year variations in corn production to corresponding variations in total feed concentrates fed. During 1926–37 a 10-percent change in corn production was associated on the average with a 5.2 percent change in total concentrates fed. The 2 variables moved in opposite directions in only 1 of the 11 year-to-year changes. In terms of actual quantities, a change of 10 million tons in corn production was typically accompanied by a change of 8 million tons in total concentrates fed.

During 1938–50, however, changes of 10 percent in corn production were associated on the average with changes of only 2.3 percent in total concentrates fed. In 6 years out of 13, the two series changed in opposite directions. This result was due largely, but by no means entirely, to the price-support programs for feed grains. Considerable quantities of wheat and imported small grains were fed during World War II, and the then-record corn carry-over with which we entered the war was used primarily to meet increased requirements rather than to offset variations in corn yields. Under ordinary conditions, the current price-support program should greatly reduce the preprogram variations in total concentrates fed, but the latter would still be expected to change in the same direction as feed-grain production in most years.

The World War II experience raises an extremely important question as to grain-storage policy. In the event of war, reserves of feed grains could be used to obtain a quick increase in livestock production. The livestock most dependent upon feed grains, namely, hogs, chickens, and turkeys, are also the species which can be expanded most rapidly in case of need. Pork and poultry meat are largely substitutable for

beef, supplies of which in most phases of a cattle cycle would be considerably short of effective demand, including military requirements. It is exceedingly difficult to obtain a substantial increase either in live-weight production of cattle, or in their slaughter for beef, within a short space of time. The course of the cattle cycle which ran from 1938 to 1948 was not visibly different from earlier cycles which occurred during periods of peace. The cattle cycle which ran from 1915 to 1924 was not obviously affected by the occurence of World War I.

Thus, a reserve of feed grains held specifically for wartime contingencies would be effectively a reserve of pork, lard, eggs, and poultry meat. Such a reserve could also be used to obtain smaller, but important, increases in the production of milk. But serious dangers would be involved in using reserves needed to offset yield variations for the purpose of meeting increased demands. The weather hazard would still be present, and the consequences of short yields due to drought or other causes occurring at a time of peak military effort and depleted feed reserves would need to be seriously considered.

SUPPLEMENT 3—HISTORICAL VARIATIONS IN DEMAND

Earlier in this report, it was pointed out that stocks of storable commodities could be used to offset variations in demand as well as in yield and production. Market prices result from the interaction of supply and demand. Hence, the actual price variation during a given period can be divided into two portions: one caused by variations in supply and the other by variations in demand.

If the fluctuating market price were replaced by a fixed support and resale price, the supply and demand changes which normally caused variations in price would be translated into variations in stocks and consumption. If demand remained constant, an increase in crop production would cause an equal increase in stocks (providing that production and consumption had been equal in the year used for comparison). If production remained constant, an increase in demand would draw some quantities out of storage, and a decrease in demand would lead to an increase in stocks.

Since 1941 the price-support programs for wheat, corn, and cotton have roughly approximated this model. Support has been offered at 90 percent of parity during most of this period. However, resale prices were generally somewhat higher than support prices, with market prices in some years below and some years considerably above the minimum resale levels. The correspondence between actual experience and the "logical" pattern previously described was therefore far from perfect. Nevertheless, wheat, corn, and cotton carry-overs fluctuated over wide ranges, with production changes dominant in some years and demand changes (both domestic and export) in others.

In establishing a storage program with the primary object of offsetting variations in yields, then, it is important to consider the possible effects of variations in demand. If these effects prove small relative to those of yield variability, little or no modification in reserve levels will be required on their account. But if the demand effects prove large, they cannot be disregarded. Otherwise, stocks originally built up as a protection against drought might be dissipated in a period of normal weather but high demand. For it is inescapable that a storage pro-

gram which stabilizes the price of a commodity will be affected by variations in both the yield and demand factors.

The relative importance of different sources of demand varies greatly from commodity to commodity. The demand for feed grains is derived from the demand for livestock products. The great bulk of our production of meats, dairy products, poultry, and eggs is consumed domestically. The domestic food use of wheat is extremely stable, but exports and feed use have varied tremendously. The domestic mill consumption of cotton has varied considerably with domestic income and industrial production, and exports have also fluctuated widely. It will be necessary, therefore, to take up each commodity in turn.

Demand for corn and other feed grains.—Some major aspects of the demand for corn can be inferred from figure 8, and from the more detailed data in table 13. The domestic nonfeed uses of corn (as for corn meal, corn sugar, sirup, starch, alcohol, distilled spirits, and seed) are relatively stable, and require less than 10 percent of an average corn crop. Exports have rarely exceeded 100 million bushels, or 3 or 4 percent of an average crop, and imports exceeded 100 million bushels in only one year. In most years, some 90 percent of the corn crop is fed to livestock, and, in the absence of price support, the bulk of the variations in corn production have been transmitted into variations in the quantity fed. Changes in stocks helped to cushion the impact of production variations even prior to the establishment of a price-support program, but have been considerably more important since about 1937.

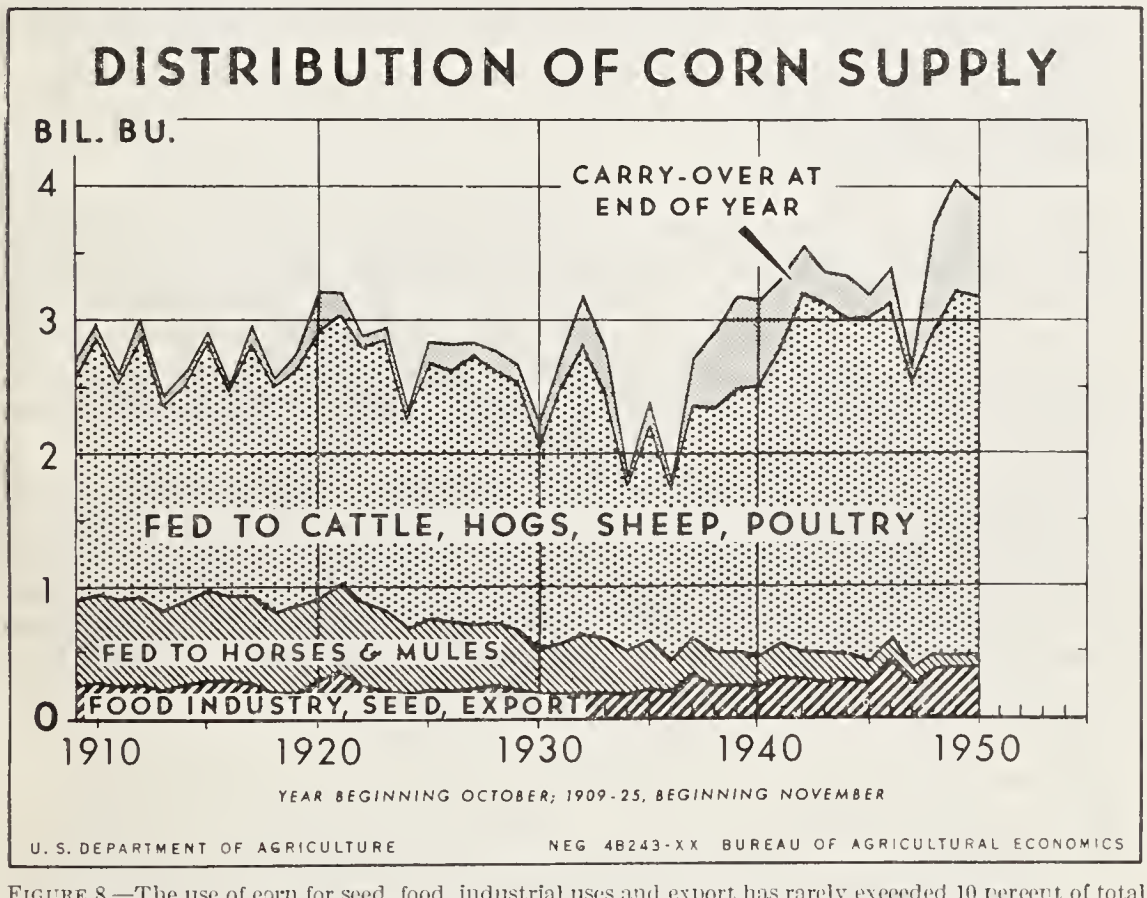

FIGURE 8.—The use of corn for seed, food, industrial uses and export has rarely exceeded 10 percent of total utilization. The remaining 90 percent has been fed to livestock. An increasing proportion of the total supply has been available for production of food livestock products, as numbers of horses and mules have trended downward. Prior to 1937 changes in the corn carry-over were fairly small. Since the inauguration of a price-support program for corn the absolute level and the year-to-year changes in corn stocks have been much more important.

TABLE 13.—*Corn: Supply and distribution, United States, 1926–51*

[Million bushels]

Year beginning October	Supply				Distribution							
	Stocks, Oct. 1 [1]	Production	Imports	Total	Wet and dry processing [2]	Alcohol and distilled spirits	Seed	Livestock feed [3]	Total domestic disappearance [4]	Exports [5]	Total disappearance	Stocks end of year [1]
1926	280	2,547	3	2,830	173	8	18	2,398	2,597	16	2,613	217
1927	217	2,616	3	2,836	184	6	18	2,515	2,723	19	2,742	94
1928	94	2,666	(6)	2,760	186	10	18	2,358	2,572	41	2,613	147
1929	147	2,516	1	2,664	173	10	18	2,315	2,516	8	2,524	140
1930	140	2,080	1	2,221	155	2	20	1,874	2,051	2	2,053	168
1931	168	2,576	(6)	2,744	149	5	20	2,296	2,470	4	2,474	270
1932	270	2,930	(6)	3,200	155	6	20	2,625	2,806	8	2,814	386
1933	386	2,398	1	2,785	159	12	18	2,254	2,443	4	2,447	338
1934	338	1,449	37	1,824	142	23	18	1,575	1,758	1	1,759	65
1935	65	2,299	21	2,385	164	35	18	1,991	2,208	1	2,209	176
1936	176	1,506	104	1,786	151	32	17	1,520	1,720	(6)	1,720	66
1937	66	2,643	1	2,710	156	18	16	2,020	2,210	139	2,349	361
1938	361	2,549	1	2,911	161	18	15	2,099	2,293	34	2,327	584
1939	584	2,581	1	3,166	170	19	14	2,231	2,434	44	2,478	688
1940	688	2,457	1	3,146	190	26	13	2,257	2,486	15	2,501	645
1941	645	2,652	(6)	3,297	220	54	12	2,500	2,786	20	2,806	491
1942	491	3,069	(6)	3,560	228	42	13	2,909	3,192	5	3,197	[1] 363
1943	384	2,966	4	3,354	223	11	13	2,866	3,113	10	3,123	231
1944	231	3,088	6	3,325	226	37	12	2,718	2,993	17	3,010	315
1945	315	2,869	1	3,185	202	27	12	2,752	2,993	20	3,013	172
1946	172	3,217	1	3,390	243	55	12	2,670	2,980	127	3,107	283
1947	283	2,355	(6)	2,638	201	30	12	2,265	2,508	7	2,515	123
1948	123	3,605	1	3,729	212	30	12	2,551	2,805	111	2,916	813
1949	813	3,239	1	4,053	222	36	11	2,832	3,101	107	3,208	845
1950	845	3,058	1	3,904	232	45	11	2,770	3,058	107	3,165	739
1951	739	2,941	------	3,680	------	------	------	------	------	------	------	------

[1] Farm terminal market and Government-owned stocks 1937–42. Stocks in all positions, including interior mill, elevator, and warehouse stocks, 1943 to date.
[2] Processed into starch, sugar, sirup, corn meal, grits, breakfast foods, etc., for food and industrial uses.
[3] Residual, includes waste and loss.
[4] Includes exports of grain products.
[5] Grain only.
[6] Less than half-million bushels.

The price and demand structure of the feed-grain-livestock portion of our national economy is extremely complex, looked at in detail. But the major demand factor affecting the price and utilization of corn and other feed grains is the income of domestic consumers which makes effective their desires for meat, milk, and poultry products. Consumer expenditures for meat are closely related to disposable consumer income, as illustrated by figure 9.

Changes in consumer expenditures for meat trace themselves back into changes in livestock prices which also induce similar changes in the price of and demand for corn. For example, an increase in the price of hogs means a corresponding increase in the value of corn as a raw material for hog production. Similarly, changes in the production of corn or available supplies of feed concentrates have an important effect upon corn prices and livestock production.

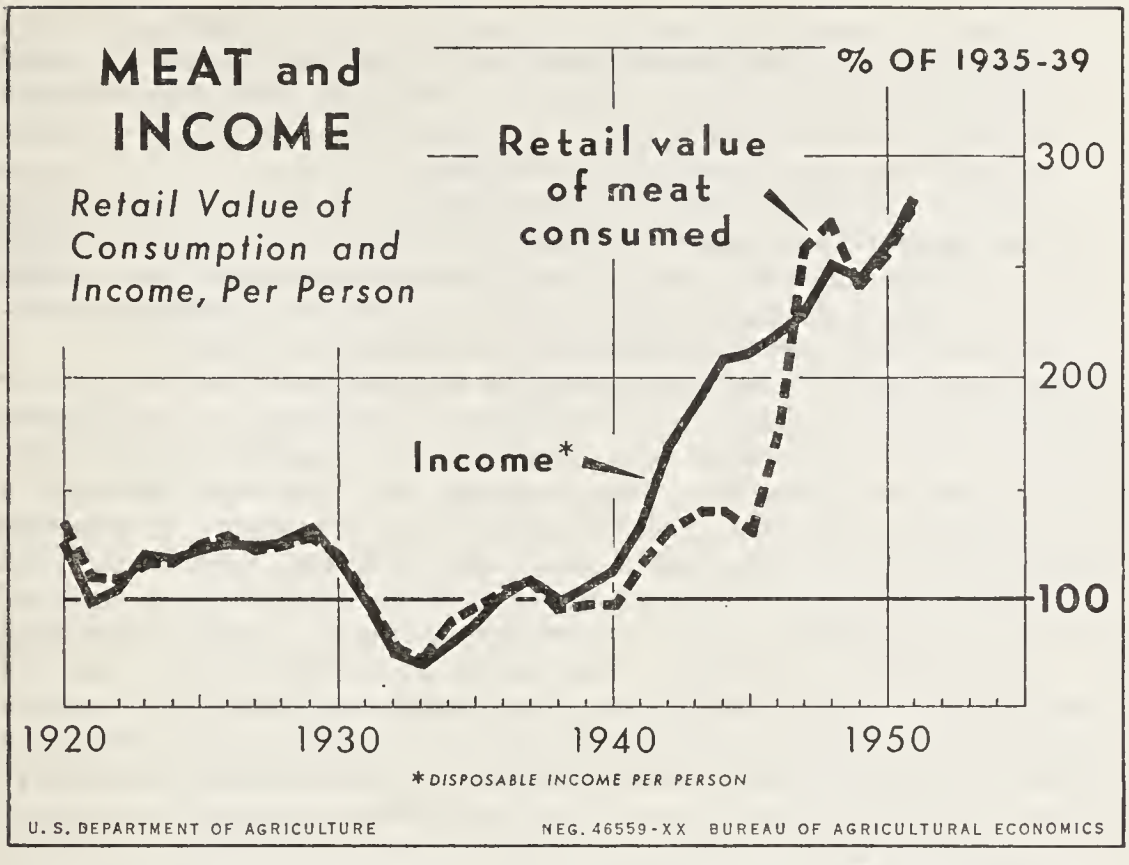

FIGURE 9.—The retail value of meat consumed in the United States has borne a fairly stable relationship to disposable consumer income. This relationship was disturbed by price control and rationing during World War II and to some extent by the immediate postwar inflation. An increase of 1 percent in consumer income is generally accompanied by a similar increase in retail meat prices if meat supplies per person remain constant. But at the same time farm prices of meat animals and demand for feed grains are also increased.

The following tabulation is an effort to state as simply as possible some of the interrelationships existing within the feed-grain-livestock field. The effects of these interrelationships are stated in terms of averages prevailing during the interwar years, 1922–41. The direction and magnitude of these effects still appear to be much the same as those existing during the interwar period. The major relationships are—

(*a*) A 1 percent change in disposable consumer income is associated with an average change of 0.8 to 0.9 percent in retail prices of meat, dairy, and poultry products. Farm prices of livestock products generally change about 1.5 percent for a 1 percent change in their retail prices, and the farm price of corn changes about 1 percent in response to a 1 percent change in farm prices of livestock products, if livestock production remains constant. Linking the successive steps together, a 1 percent change in disposable consumer income leads, on the average, to about a 1.3 percent change in the farm price of corn.

(*b*) In the absence of corn-price supports, a 1 percent change in corn production is directly associated with an 0.6 percent change in the supply of privately held feed concentrates—that is, feed supplies excluding CCC stocks. And a 1 percent change in the supply of feed concentrates (ex-CCC stocks) is associated with an opposite change of 2 percent in the market price of corn.

(*c*) A 1 percent change in the supply of privately held feed concentrates is associated with an 0.9 percent change in total concentrates fed, while a 1 percent change in total concentrates fed is in turn associated with an average change of 0.34 percent in total volume of livestock production.

(*d*) A 1 percent change in the volume of livestock production is associated with an opposite change of about 2 percent in livestock prices and 1 percent in the value of livestock products (farm basis). A 1 percent change in farm value of livestock products is associated with a similar change in the farm price of corn.

The above set of average relationships is stated in terms of direct or immediate effects. There are a number of indirect or cumulative effects which work themselves out over time and tend to modify some of the direct relationships. For example, a 1 percent increase in corn production (assuming the absence of price-support or storage-program effects) has the direct effect of increasing supplies of feed concentrates about 0.6 percent, which in turn depresses the price of corn about 1.2 percent (since a 1 percent increase in supplies of total feed concentrates depresses corn prices 2 percent). The indirect effect of this change in corn prices, distributed over time, is an increase of about 0.2 percent in livestock production, which leads through a decrease in livestock prices and value to a corresponding decrease of 0.2 percent in the price of corn. That is, if time lags were disregarded, the total effect of a 1 percent change in corn production, without any offsetting storage or price-support operations, would be an opposite change of about 1.4 percent in corn prices.

The two cumulative relationships—a change of 1.3 percent in corn prices for each 1 percent change in consumer incomes and a change of 1.4 percent in the opposite direction for each 1 percent change in corn production—represent the "leverage" of the two factors upon corn prices in the absence of price support. The importance of each factor for a price-support and storage program also depends on its basic variability. During 1926–37, for example, year-to-year changes in consumer income averaged a little less than half as large percentage-wise as changes in corn production. If changes in the two factors had been uncorrelated, the combined effect of the two upon corn prices could have been offset with storage operations only about 10 percent larger than those needed to offset production variations alone. Actual analysis of year-to-year changes during 1919–41 indicates that much less than a 10 percent "over-run" would have been needed to cover demand in addition to supply variations. However, this conclusion does not take account of the cumulative swings in consumer income over a period of years, as from 1929 to 1932 and 1932 to 1937. Further, the increases in demand have been much greater since 1941 than was the case in the interwar years 1919–41.

In appraising possible future corn-storage programs, we have reason to assume that variations in corn production will continue much as in the past. However, variations in consumer income are influenced by human action and are basically subject to human control. If we are successful in maintaining a high and fairly stable level of employment, as we have done during the past several years, peacetime variations in demand will have little impact on corn-storage and price-support programs.

But this does not apply to possible demand impacts in time of war. World War II brought a tremendous increase in employment and consumer income. This in itself meant an unprecedented level of demand for livestock products. Civilian demand for food was intensified by shortages of consumer durable goods, new housing, and other normal objects of expenditure. The fixing of retail prices meant that increased money income was translated into an effective demand for increased quantities of livestock products. Per capita consumption of pork, chicken, turkey, eggs, and fluid milk and cream increased by 20 to 50 percent from 1935–39 to 1944. Per capita supplies of beef, lamb, cheese, evaporated milk, and, above all, butter available to civilians were at or below prewar levels and were considerably short of demand at ceiling prices.

Superimposed on this expanded civilian demand were heavy requirements for our Armed Forces and our allies. These special war requirements in 1944 took meat equivalent to 30 percent of the total amount consumed by United States civilians; also, dairy products equivalent to 18 percent, eggs to 35 percent, and poultry meat to 15 percent of total civilian consumption.

To meet these vastly increased requirements, farmers succeeded in expanding livestock production by 38 percent over the 1935–39 level. Feed concentrates fed to livestock in the 1943–44 feeding year totaled 48 percent greater than the 1935–39 average, and the quantity of corn fed to livestock was up 45 percent, from 2.0 to 2.9 billion bushels. This was based, of course, on a similar expansion in corn production. The total feed supply during World War II was augmented by substantial quantities of domestic wheat, and also by wheat, oats, and barley imported from Canada. These grains were available in both the United States and Canada mainly because the export market was disrupted by war. The large carry-over stocks of grain with which we entered World War II (645 million bushels of corn in October 1941 and 631 million bushels of wheat at the end of the 1941–42 marketing season) were also substantially depleted in the process of expanding livestock production.

The years since World War II have been characterized by high employment, rapidly increasing population, and a per capita consumption of livestock products well above the prewar level. Exports of corn have slightly exceeded 100 million bushels in 4 of the past 5 years. This is still small relative to the total quantities of grains and other feed concentrates used in the United States. Nevertheless, it is important.

Demand for wheat.—Some basic aspects of the demand for wheat are indicated by table 14. In the first place, domestic food use has been extremely stable at a little below 500 million bushels, and has been almost wholly unresponsive to changes in the price of wheat. Seed requirements average a little over a bushel per planted acre and have totaled about 80 to 90 million bushels annually in recent years. Industrial use of wheat (as for alcohol) has been almost negligible except for some emergency use during World War II. Imports have also been negligibly small in most years. The imports during the 1943 and 1944 crop years were mainly for feed use, as are the imports estimated for 1951–52.

TABLE 14.—*Wheat supply and distribution, United States, 1923–51*

[Million bushels]

Year beginning July	Supply				Domestic disappearance				Exports [2]	Carryout
	Carryin	Production	Imports	Total	Food use	Seed and industrial	Fed to livestock [1]	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1923	132	759	15	905	485	74	60	619	149	137
1924	137	842	[3]	979	489	80	44	613	258	108
1925	108	669	2	779	509	79	−3	585	97	97
1926	97	832	[3]	929	512	83	16	611	209	109
1927	109	875	[3]	984	512	90	75	677	194	113
1928	113	914	[3]	1,027	516	84	56	656	144	227
1929	227	824	[3]	1,051	511	83	23	617	143	291
1930	291	887	[3]	1,178	500	81	169	750	115	313
1931	313	942	[3]	1,255	498	80	176	754	126	375
1932	375	756	[3]	1,131	508	84	126	718	35	378
1933	378	552	[3]	930	465	78	86	629	28	273
1934	273	526	16	815	475	83	98	656	13	146
1935	146	628	35	809	484	88	90	662	7	140
1936	140	630	34	804	489	96	104	689	12	103
1937	[4] 83	874	1	958	485	93	120	698	107	153
1938	153	920	[3]	1,073	496	74	142	712	111	250
1939	250	741	[3]	991	490	73	100	663	48	280
1940	280	815	4	1,099	492	74	110	676	38	385
1941	385	942	4	1,331	473	64	131	668	32	631
1942	631	969	1	1,601	500	120	329	949	33	619
1943	619	844	136	1,599	482	185	569	1,236	46	317
1944	317	1,060	42	1,419	472	163	357	992	148	279
1945	279	1,108	2	1,389	474	103	317	894	395	100
1946	100	1,152	[3]	1,252	483	87	197	767	401	84
1947	84	1,358	[3]	1,442	489	91	176	756	490	196
1948	196	1,295	2	1,493	480	95	103	678	508	307
1949	307	1,098	2	1,407	484	80	115	679	303	425
1950	425	1,019	12	1,456	479	86	126	691	369	396
1951 [5]	396	987	40	1,423	485	90	124	699	454	270

[1] Residual item; roughly approximates feed use.
[2] Includes shipments to United States Territories.
[3] Less than half-million bushels.
[4] Prior to 1937 some new wheat included; beginning with 1937 only old-crop wheat in all positions.
[5] Preliminary.

The remaining domestic category of wheat utilization is livestock feeding. Prior to World War II wheat feeding (as whole grain and in mixed feeds) averaged around 100 million bushels. Wheat feeding was greatly expanded during World War II with the aid of subsidies which made the cost of wheat for feed use about equal to that of corn. Since the war wheat feeding has apparently averaged about 150 million bushels. As long as wheat prices are substantially higher than corn prices, wheat feeding is not likely to exceed 200 million bushels.

Under peacetime conditions, then, total domestic disappearance of wheat is quite stable, and variations in domestic demand are not likely to complicate a price support or storage program for wheat. The major demand factor in need of appraisal is the demand for wheat exports.

Wheat exports were large immediately after World War I, but trended downward during the later 1920's. The 1933–36 drought practically eliminated exports, and exports were exceeded by imports in 1934–36. Exports again rose above 100 million bushels in each of the 2 years immediately preceding the outbreak of World War II in Europe.

These trends and fluctuations in wheat exports from the United States were partly offset (and partly caused) by changes in exports

from other countries and by changes in production in Europe, the principal importing area (table 15). In the 1937 and 1938 crop-years, United States exports were less than 20 percent of total world exports, and our exports specifically to Europe were equivalent to about 5 percent of European production. Under these circumstances the world wheat economy was flexible enough to absorb fluctuations in United States exports. From our own standpoint, the export market was largely a residual or "overflow" market during the 1930's.

TABLE 15.—*Wheat, including flour: Exports by major exporting countries, and European production, 1920–51*

[Million bushels]

Year beginning July	United States	Canada	Australia	Argentina	Other	Total world	Production, Europe, excluding U. S. S. R.
1920	312	167	87	193	8	767	955
1921	265	186	117	109	20	697	1,230
1922	205	275	50	145	12	687	1,050
1923	146	344	83	170	52	795	1,265
1924	255	195	124	125	31	730	1,065
1925	95	321	77	100	70	663	1,400
1926	206	305	97	138	94	840	1,215
1927	191	306	73	168	62	800	1,275
1928	141	423	108	227	51	950	1,410
1929	140	184	62	161	85	632	1,435
1930	112	267	143	121	185	828	1,360
1931	123	200	155	145	174	797	1,435
1932	32	267	149	120	53	621	1,490
1933	26	198	86	145	87	542	1,745
1934	11	170	108	187	47	523	1,550
1935	4	237	105	77	90	513	1,510
1936	9	213	98	163	134	617	1,385
1937	100	95	123	70	144	532	1,470
1938	107	160	96	116	153	632	1,765
1939	45	210	79	177	106	617	1,645
1940	34	209	83	100	53	479	1,265
1941	28	235	41	84	41	429	1,360
1942	27	195	39	72	14	347	1,270
1943	40	342	61	95	29	567	1,450
1944	142	320	58	101	4	625	1,395
1945	388	360	38	68	1	855	985
1946	394	232	49	60	22	757	1,330
1947	479	209	104	102	39	933	1,005
1948	503	222	126	61	60	972	1,455
1949	298	236	114	86	88	822	1,500
1950 [1]	365	227	127	103	100	922	1,525
1951 [2]	450					975	1,580

[1] Preliminary.
[2] Partly forecast.

But the situation since World War II has been materially different. During the 1948–50 crop years, the United States accounted for 43 percent of world wheat exports. Our exports to Europe were equivalent to about 17 percent of wheat production in Europe excluding the U. S. S. R. In addition, we have exported substantial quantities of wheat to Japan, Korea, and India which were not among our normal outlets prior to the war. The distribution of United States wheat exports by country of destination is shown in table 16. Recent exports also reflect our postwar military responsibilities in Germany and Japan. A large proportion of our total exports in the 1949 through 1951 crop years have moved under the International Wheat Agreement, which has also tended to stabilize our export trade in wheat (last two columns, table 16).

TABLE 16.—*Wheat, including flour: United States exports, average 1937 and 1938, annual 1946–50, and sales for export under International Wheat Agreement, 1949 and 1950, by countries of destination*

[Million bushels]

Destination	Exports, year beginning July						Sales for export under International Wheat Agreement, year beginning August—	
	Average, 1937–38	1946	1947	1948	1949	1950	1949	1950
Europe: [1]								
ERP participating:								
Austria	------	11.8	20.8	20.1	20.5	11.9	11.1	10.4
Belgium and Luxembourg	12.8	15.4	11.6	15.7	10.0	18.1	9.4	10.6
Denmark	------	------	.9	------	1.0	2.2	1.4	1.7
France and French North Africa	.8	12.4	59.8	12.0	.6	1.2	------	------
Germany	2.0	80.9	138.4	128.1	78.6	66.1	31.8	57.5
Greece	1.4	10.3	22.8	24.1	18.1	20.6	15.8	15.2
Iceland	------	------	.1	.2	.3	------	------	------
Ireland	------	2.2	4.1	3.7	2.8	2.5	3.3	1.7
Italy and Trieste	1.0	35.4	49.1	65.4	8.7	15.4	13.0	14.4
Netherlands	15.8	18.6	24.2	23.6	20.1	22.2	22.7	20.5
Norway	.6	5.8	3.9	8.8	5.8	4.8	6.1	4.8
Portugal	------	5.3	6.6	11.6	6.7	5.7	4.8	4.8
Sweden	------	.3	2.1	.1	------	.9	------	.9
Switzerland	------	6.1	4.9	9.1	------	4.9	------	4.4
Turkey	------	------	.3	------	5.0	2.2	------	------
United Kingdom	35.6	30.7	3.4	9.7	17.2	36.5	17.8	24.2
Total	70.0	235.2	352.6	332.2	195.4	215.2	137.2	171.1
Other European countries:								
Spain	------	------	------	------	------	5.2	------	3.1
Other [2]	4.0	17.1	7.1	2.0	4.1	1.9	------	------
Total	4.0	17.1	7.1	2.0	4.1	7.1	------	3.1
Total Europe	74.0	252.3	359.7	334.2	199.5	222.3	137.2	174.2
Africa [3] (total)	([4])	([4])	2.7	7.5	------	6.2	.4	3.8
Asia:								
China and Taiwan	6.0	5.6	4.0	4.2	.4	1.5	------	------
India	------	21.4	15.0	23.5	.9	29.6	------	27.8
Pakistan	------	------	.3	.7	------	------	------	------
Japan, Ryukyu, Korea	------	36.1	45.3	64.3	58.5	42.2	------	------
Philippine Republic	4.0	7.1	4.7	7.6	4.4	5.3	2.4	3.5
Other	------	------	------	[5] 6.8	[5] 6.7	[5] 8.5	[6] 2.3	[6] 6.6
Total Asia	10.0	70.2	69.0	107.1	70.9	87.1	4.7	37.9
Western Hemisphere:								
Canada	------	------	.8	.5	.5	2.6	------	------
Latin-American Republic	9.6	46.8	35.9	48.4	25.8	41.9	20.3	33.2
Other [7]	([4])	([4])	([4])	1.9	0	1.6	------	------
Total Western Hemisphere	------	------	------	50.8	26.3	46.1	20.3	33.2
Other areas	9.6	25.4	13.5	3.0	1.8	3.5	------	------
Total exports	103.2	394.7	478.1	502.6	298.5	365.2	162.6	249.1

[1] Including French North Africa (i. e., Algeria, French Morocco, and Tunisia), and Turkey.
[2] Azores, Gibraltar, Malta, Gozo and Cyprus, Yugoslavia, Finland and Albania, Bulgaria, Czechoslovakia, Estonia, Hungary, Latvia, Lithuania, Poland, and Rumania.
[3] Excluding French North Africa
[4] Included in "other areas."
[5] Syria, Lebanon, Iraq, Iran, Israel, Transjordan, Kuwait, Saudi Arabia, Arabian peninsula states not elsewhere specified, Aden, Bahrein, Afghanistan, Ceylon, Burma, Thailand, French Indochina, French India, British Malaya, Indonesia, Portuguese Asia, southern and southeastern Asia not elsewhere specified, and Hong Kong.
[6] Indonesia and Lebanon.
[7] Miquelon and St. Pierre, British Honduras, British West Indies, Netherlands Antilles, French West Indies, British Guiana, French Guiana, Surinam, Falkland Islands, and Greenland.

It seems clear that our interests and, to some extent, responsibilities make it more important now than formerly to avoid wide fluctuations in wheat exports. The International Wheat Agreement repre-

sents an attempt to stabilize the demand for wheat exports as well as the world supply of wheat available for export. There are major policy questions in this field, extending into the whole pattern of world economic and political relationships which we now have and those which, as a matter of national policy, we may wish to achieve. To the extent that world conditions and our over-all foreign policies tend to stabilize the export demand for wheat at a high level, it would seem in the interest of wheat producers to maintain adequate stocks to meet this export demand in the face of fluctuations in wheat yields.

Demand for cotton.—Table 17 shows the supply and distribution of cotton in the United States from 1919 to date. The domestic mill consumption of cotton has fluctuated with changes in consumer income and the level of industrial production. Figure 10 shows the relative movements of these demand indicators and of domestic mill consumption of cotton from 1920 to 1951. Industrial production has some immediate importance as a demand factor, since a substantial fraction of total cotton consumption goes into industrial fabrics which are not purchased as such by individual consumers. Consumer income operates through consumer purchases of clothing and household

TABLE 17.—*Cotton: Supply and distribution, United States, 1919–51*

Crop year beginning Aug. 1—	Supply				Distribution		
	Stocks Aug. 1	Production	Imports [1]	Total	Mill consumption	Exports	Stocks end of year
	1,000 running bales	*1,000 running bales*	*1,000 bales (500 pounds)*	*1,000 bales*	*1,000 running bales*	*1,000 running bales*	*1,000 running bales*
1919	4,287	11,326	700	16,313	6,420	6,545	3,563
1920	3,563	13,271	226	17,060	4,893	5,745	6,534
1921	6,534	7,978	363	14,875	5,910	6,184	2,832
1922	2,832	9,729	470	13,031	6,666	4,823	2,325
1923	2,325	10,171	292	12,788	5,681	5,656	1,556
1924	1,556	13,639	313	15,508	6,193	8,005	1,610
1925	1,610	16,123	326	18,059	6,456	8,052	3,543
1926	3,543	17,755	401	21,699	7,190	10,927	3,762
1927	3,762	12,783	338	16,883	6,834	7,542	2,537
1928	2,536	14,297	458	17,291	7,091	8,044	2,312
1929	2,312	14,548	378	17,238	6,106	6,690	4,530
1930	4,530	13,756	108	18,394	5,263	6,760	6,370
1931	6,370	16,629	132	23,131	4,866	8,708	9,678
1932	9,678	12,710	130	22,518	6,137	8,419	8,165
1933	8,165	12,664	148	20,977	5,700	7,534	7,744
1934	7,744	9,472	107	17,323	5,361	4,798	7,208
1935	7,208	10,420	155	17,783	6,351	5,973	5,409
1936	5,409	12,141	253	17,803	7,950	5,440	4,499
1937	4,499	18,252	159	22,910	5,748	5,598	11,533
1938	11,533	11,623	150	23,306	6,858	3,327	13,033
1939	13,033	11,481	168	24,682	7,784	6,163	10,564
1940	10,564	12,298	193	23,055	9,722	1,112	12,166
1941	12,166	10,495	274	22,935	11,170	1,125	10,640
1942	10,640	12,438	178	23,256	11,100	1,480	10,657
1943	10,657	11,129	135	21,921	9,943	1,138	10,744
1944	10,744	11,839	193	22,776	9,568	[2] 1,924	11,164
1945	11,164	8,813	349	20,326	9,163	[2] 3,553	7,326
1946	7,326	8,517	284	16,127	10,025	3,544	2,530
1947	2,530	11,557	244	14,331	9,354	1,968	3,080
1948	3,080	14,580	173	17,833	7,795	4,747	5,287
1949	5,287	15,909	254	21,450	8,851	5,771	6,846
1950 [3]	6,846	9,908	207	16,961	[4] 10,509	4,117	2,278
1951 [3]	2,278	[5] 15,050					

[1] Imports for consumption.
[2] Excludes War Department shipments.
[3] Preliminary.
[4] Adjusted to calendar year.
[5] Preliminary, ginnings estimate as reported by the Bureau of the Census on Mar. 20, 1952. Data includes 30,147 bales estimated to be ginned after the March canvass.

Compiled from reports of the Bureau of the Census.

textiles. Cotton goes through expensive and time-consuming processes between mill and consumer, and inventory fluctuations of considerable magnitude can and do occur. Also, cotton textiles in the hands of consumers are only semiperishable. Consequently, year-to-year changes in mill consumption of cotton are sharper and more erratic than changes in consumer income. The long-time upward trend in mill consumption is largely a reflection of population growth as well as a rising standard of living.

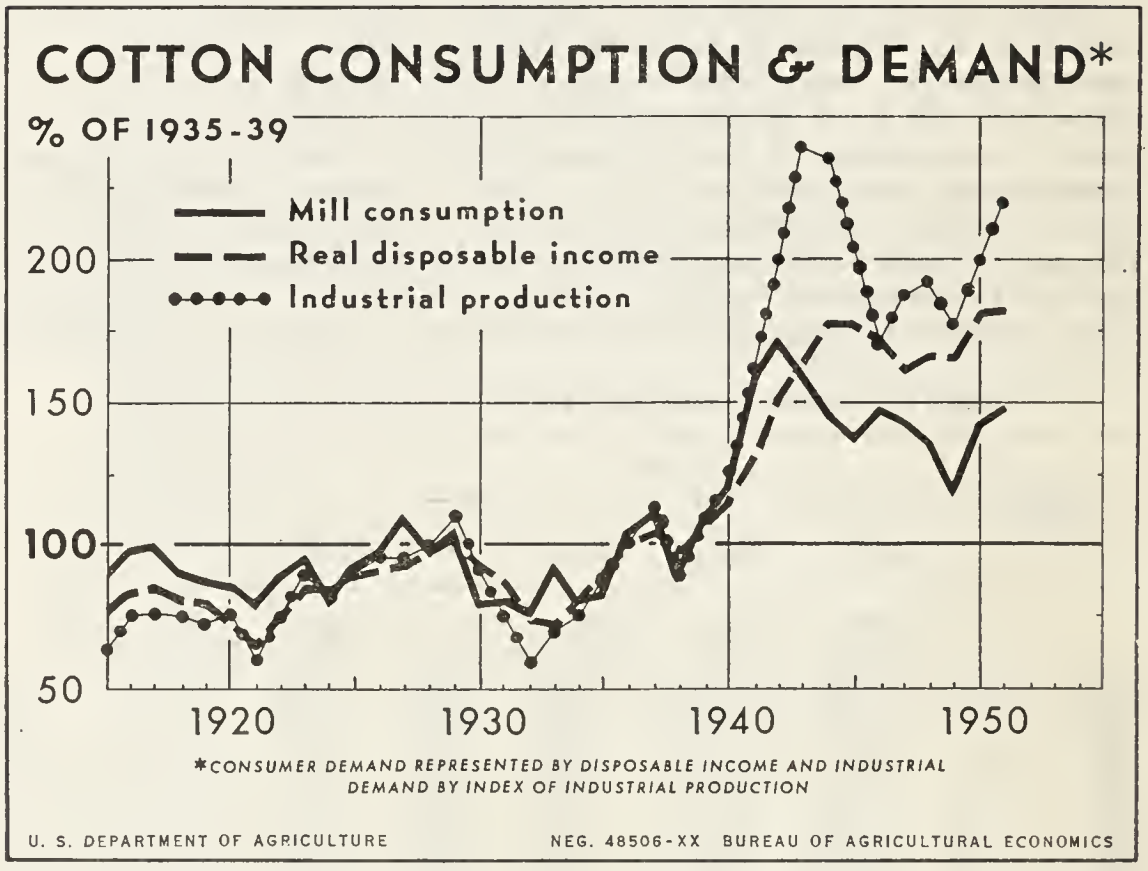

FIGURE 10.—About two-thirds of the domestic utilization of cotton is in the form of apparel and household textiles. The remainder goes into industrial fabrics and miscellaneous uses. Demand for cotton in the two groups of uses is roughly indicated by consumer income and total industrial production, and mill consumption of cotton is associated with these demand indicators in their major swings. The increasing use of synthetic fibers has also been a factor influencing the demand for cotton, especially since 1939.

The demand for cotton has also been affected by competition from synthetic fibers, chiefly rayon. Over the 30-year period shown, cotton consumption per person increased only moderately while rayon consumption per person rose from virtually nothing in 1919 to almost 9 pounds in 1950 (table 18). It is clear that there has been considerable substitution of rayon for cotton (within the framework of an expanded total demand for fibers), and in terms of holding markets, it would appear to be in the interest of cotton producers to maintain adequate supplies of cotton to meet domestic demand in full. Apparently, even a temporary shortage of cotton stimulates the substitution of synthetic fibers in hitherto untried or unimportant uses, setting in motion processes that may not be reversible when supplies of cotton again increase.

TABLE 18.—*Per capita consumption of cotton, rayon, apparel wool, and other fibers, United States, 1919–51*

[Pounds]

Calendar year	Cotton	Rayon [1]	Apparel wool	Other [2]	Total
1919	27.00	0.09	2.67	0.62	30.38
1920	26.31	.08	2.46	.48	29.33
1921	23.79	.18	2.74	.55	27.26
1922	26.25	.22	2.82	.63	29.92
1923	27.71	.29	2.76	.69	31.45
1924	22.95	.37	2.17	.59	26.08
1925	26.37	.50	2.16	.76	29.79
1926	27.19	.51	2.15	.79	30.64
1927	29.97	.84	2.16	.81	33.78
1928	26.27	.83	1.92	.83	29.85
1929	27.94	1.09	2.07	.90	32.00
1930	21.14	.96	1.62	.78	24.50
1931	21.27	1.27	1.90	.76	25.20
1932	19.62	1.24	1.50	.66	23.02
1933	24.15	1.72	1.94	.64	28.45
1934	20.92	1.55	1.32	.57	24.36
1935	21.53	2.02	2.49	.67	26.71
1936	26.93	2.50	2.33	.62	32.38
1937	28.14	2.35	2.12	.61	33.22
1938	22.33	2.52	1.68	.47	27.00
1939	27.55	3.48	2.23	.53	33.79
1940	29.77	3.62	2.33	.49	36.21
1941	38.69	4.41	3.83	.36	47.29
1942	41.51	4.57	4.13	.36	50.57
1943	38.30	4.77	4.38	.38	47.83
1944	34.39	5.06	4.14	.42	44.01
1945	32.07	5.47	4.18	.43	42.15
1946	33.80	6.15	4.28	.58	44.81
1947	32.18	6.81	3.63	.42	43.04
1948	30.26	7.79	3.29	.60	41.94
1949	25.59	6.62	2.26	.68	35.15
1950	30.69	8.86	2.86	1.09	43.50
1951	31.26	8.22	2.43	1.47	43.38

[1] Includes staple fiber since 1928.
[2] Includes flax and silk through 1939; since 1940 flax, silk and "other synthetic fibers."

Exports of cotton have fluctuated even more violently than has domestic consumption (table 17). Policies of national self-sufficiency in many countries, including the encouragement of their own rayon industries, led to a basic downtrend in demand for American cotton during the 1930's. Hitler's conquests during the early part of World War II cut off many of our customary importers and his inroads on shipping cut down our exports to other countries such as the United Kingdom, which were not overrun. Germany, Italy, and Japan had also been major importers before the war. Even during the postwar period our cotton exports have fluctuated markedly from year to year, depending largely upon the incidence of dollar shortages and of measures such as the European Recovery Program which supplied additional funds for the purchase of American cotton.

Table 19 shows exports of United States cotton by destination during the postwar years. The basic pattern of postwar exports has been quite similar to that of earlier years such as 1935–39. During the 1948–50 crop years, over half of our cotton exports were financed under the Economic Cooperation Administration program and another 8 to 10 percent under Defense Department programs (table 20). The major importers of United States cotton also produce large quantities of rayon. Under either peacetime or emergency conditions, a shortage of cotton for export would tend to stimulate further

production of rayon in these countries. Thus, if it is considered desirable to maintain a large export market for cotton, it would also seem desirable to carry sufficient stocks to maintain exports in the event of one or more years of poor yields in the United States. Assurance of adequate supplies on a continuing basis can be as important a factor in maintaining either domestic or foreign markets as are the prices at which such supplies are offered.

TABLE 19.—*Cotton: Exports from the United States to specified countries, August–July, averages 1935–39, annual 1946–50*

[1,000 running bales]

Country of destination	Year beginning Aug. 1—					
	Average 1935–39	1946	1947 [1]	1948 [2]	1949	1950 [3]
Europe:						
United Kingdom	1,282	469	257	742	584	294
Austria	(4)	4	3	71	59	53
Belgium and Luxembourg	158	176	50	147	186	78
Czechoslovakia	61	97	21	34	55	5
Denmark	31	0	3	28	32	30
Eire	0	(4)	1	3	3	4
Finland	32	22	26	33	3	3
France	623	380	206	653	766	433
Germany	482	198	247	484	733	463
Greece	3	10	1	11	47	1
Hungary	5	0	(4)	6	23	0
Italy	420	442	67	622	718	526
Netherlands	100	112	33	184	249	152
Norway	16	4	3	16	8	19
Poland and Danzig	168	46	47	89	45	1
Portugal	34	0	0	(4)	0	2
Spain	99	41	2	68	62	63
Sweden	108	22	6	(4)	28	31
Switzerland	10	19	2	36	38	21
Trieste	0	0	0	6	3	4
U. S. S. R.	(4)	0	0	26	0	0
Yugoslavia	16	73	0	40	25	84
Other Europe	19	0	0	19	6	0
Total Europe	3,667	2,115	975	3,318	3,673	2,268
Other countries:						
Canada	288	308	136	293	272	410
Mexico	0	(4)	(4)	0	0	(4)
Cuba	10	33	13	7	18	23
Colombia	18	1	1	51	61	53
India	51	0	20	2	397	212
China	113	552	293	277	127	51
Japan	1,100	504	449	623	885	842
Hong Kong	(4)	2	0	29	138	26
Korea	0	0	59	32	51	35
Palestine and Israel	0	2	3	10	8	9
Philippine Islands	2	7	1	3	8	12
Australia	9	9	10	0	0	0
Other countries	42	11	8	102	132	177
World total	5,300	3,544	1,968	4,747	5,770	4,117

[1] Excludes War Department shipments.
[2] Includes Army civilian supply exports.
[3] Preliminary.
[4] Less than 500 bales.

All totals were made before figures were rounded.
Compiled from reports of the Bureau of the Census.

TABLE 20.—*Cotton: United States exports, by type of financing, 1948–49 to 1950–51*

[Thousand running bales]

Year	Total [1]	Government financed			Other
		ECA [1]	Defense Department [2]	Total	
1948–49	4,747	2,318	84	2,402	2,345
1949–50	5,771	3,460	1,007	4,467	1,304
1950–51	4,117	2,006	247	2,253	1,864

[1] Crop year.
[2] Fiscal year.

Data on United States financed exports obtained from ECA and Department of Defense.

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